

THE SURGICAL ANATOMY OF THE LYMPHATIC GLANDS

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THE SURGICAL ANATOMY OF THE LYMPHATIC GLANDS

By

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PREFACE

SINCE the introduction of formalin as a method of hardening and preserving the soft structures in the human subject was first introduced into this Hospital by Mr. Keith, the relations and true position of all the structures can be much more easily appreciated than was formerly the case. During the last three years I have availed myself of this method to study the exact position of the lymphatic glands; too often these structures are removed by students before their relations have been sufficiently studied. My object in venturing to bring this book to their notice is to indicate by a series of diagrams the position of the main groups of lymphatic glands, and to endeavour to show how these somewhat dry anatomical facts have an important bearing upon surgery.

No attempt, except by incidental reference, is made to point out the areas which the various groups of glands drain; this I hope to work out from a clinical point of view later on. In some instances I have availed myself of diagrams taken from well-known anatomical text books, viz. "Anterior and lateral cervical muscles" from Morris's *Anatomy*, "The axillary artery and its branches" from Gray, and "The Costocoracoid membrane"

from Cunningham's *Manual of Practical Anatomy*, all of which I have had occasion to modify more or less for the purpose of showing the relations of the glands. With these exceptions, however, all the diagrams have been made from my own preparations in the dissecting room, and the glands therein shown represent the mean of a large number of dissections made during the time I have been working at the subject.

The bodies examined have been almost entirely adults of forty years of age and upward, but a considerable number of full-term infants have also been examined. The diagrams, some of which were drawn from photographs taken by Mr. E. H. Harnack, are purposely made as simple as possible, at the same time I have endeavoured not to sacrifice accuracy of detail for clearness. I have much pleasure in acknowledging my indebtedness to Mr. Keith for many valuable suggestions, and for the trouble that he has taken in overlooking the diagrams, and correcting the proof sheets.

If this small work (the imperfections of which I am fully conscious of) should help to stimulate students to increased efforts in determining for themselves the position of the glands, and should lead them to appreciate the importance of so doing, the object for which it has been written will be accomplished.

CECIL H. LEAF.

WIMPOLE STREET, W.

INTRODUCTORY

IN the description of each of the diagrams I have classified the glands as far as possible into groups. This plan, though frequently somewhat arbitrary, has the advantage of being convenient. To some of these groups new names have been introduced ; and though there is an objection to the use of new names, yet it is hoped that those selected may indicate, with sufficient accuracy, the positions occupied by the different groups of lymphatic glands.

Though no attempt has been made to indicate the course taken by the lymphatic vessels, which in general may be said to accompany the veins, yet I wish to suggest a method of injecting them, by means of which they may be rendered so distinct that they can readily be dissected out. Hitherto nearly all the experiments which have been performed with this object have been made with either mercury or various colouring matters. The great objection to the former, as Sappey long ago pointed out, consists in the fact that if a vessel is accidentally pricked, the mercury leaks out and all trace of the vessel quickly disappears. The method by subcutaneous injection of colouring matters cannot be relied upon,

because it is most difficult to insure the point of even the finest injection syringe passing into a lymphatic vessel ; this method, moreover, presupposes an exact knowledge of the course taken by these vessels ; but this is just the point which the experimenter wishes to determine. Colouring matters, moreover, are unsatisfactory because they stain the surrounding tissues as well as the vessels. Formalin is the fluid which I have lately used almost exclusively. This was introduced into the London Hospital by Mr. Keith as a means of hardening and preserving the relations of the viscera in the human subject. Formalin is the commercial name of a saturated aqueous solution of 40 per cent. of formic aldehyde. For the objects for which it was introduced, and for rendering the dissection of the lymphatic vessels possible, it is undoubtedly of very great value. The first experiment made with this object was performed nearly two years ago on a collie dog which, on account of its poaching habits, had to be shot. An incision was made into the dorsum of the tongue, into which the rounded nozzle of a syringe was passed ; the nozzle was perforated by six or seven small holes ; round the nozzle the lips of the wound were secured as tightly as possible. The syringe was filled with Stephens' ordinary blue-black ink, which was then injected. To effect this, however, very considerable pressure had to be used on the piston. On dissecting the submaxillary region of this dog several of

the lymphatic vessels were found to be well stained and appeared quite distinct as bluish-black threads; some of the submaxillary glands were also partially stained. In the next experiment the superficial epidermis of the balls of several of the toes was scraped off and the open mouth of a syringe filled with the ink pressed firmly against the subjacent tissues. The piston was then forced down and the ink slowly disappeared. On dissection two lymphatic vessels were easily traced up to one of the deep inguinal glands which was well stained. From this the lymphatic vessels were further traced to the lumbar glands, three of which were found to be deeply stained. From the toes also two other vessels were traced up to a gland which was found to be lying underneath the gluteus maximus. This, too, was deeply stained by the ink. In both these experiments therefore, it was found that by using great pressure the lymphatic vessels could be rendered quite distinct. After some time, however, it was noticed that the ink stained the surrounding tissues as well as the vessels. It had apparently percolated through the latter into the former.

Experiments similar to those made on the dog were made on the human subject, but they ended in a complete failure. This was probably due to the fact that the subjects operated on were not perfectly fresh. The idea was nevertheless entertained that it would be quite possible to inject the lymphatic vessels in a cadaver, even if not absolutely

fresh, by passing through the vascular system an excessive quantity of formalin under a very high pressure; therefore into both the internal jugular vein and common carotid artery of a subject aged forty-five years, eleven gallons of the formalin solution (one part of formalin to seven parts of water) and about two pints of spirit were injected from March 24th to April 24th, the object being to use so much pressure that some of the excessive amount of fluid would be bound to find its way into the lymphatic vessels. The right inguinal region of this subject was dissected on April 25th. The glands here were found to be large and very hard, and on pulling them from their bed the vessels passing to and from them could be distinctly seen as somewhat semi-transparent whitish cords. Diagram 1 represents some of the superficial inguinal glands and their vessels as seen in dissection. A vessel (L) passing to one of the vertical set of superficial inguinal glands is there shown. This was traced down the thigh for nine inches. Had it been possible to thoroughly dissect out all the other vessels, some of which were larger than this one, they could undoubtedly have been traced very much further down the limb. All the vessels shown in the diagram passing to the superficial inguinal glands were traced down for at least six inches. The only other parts of this subject which I have yet had an opportunity of dissecting are: (1) the mesentery; and (2) a small portion of the pelvic region. In the former, the vessels could

fairly easily be traced from the intestinal wall to the nearest set of lymphatic glands. In the latter, lymphatic vessels could be seen passing from a gland which lies transversely over the termination of the external iliac artery to end in a group of

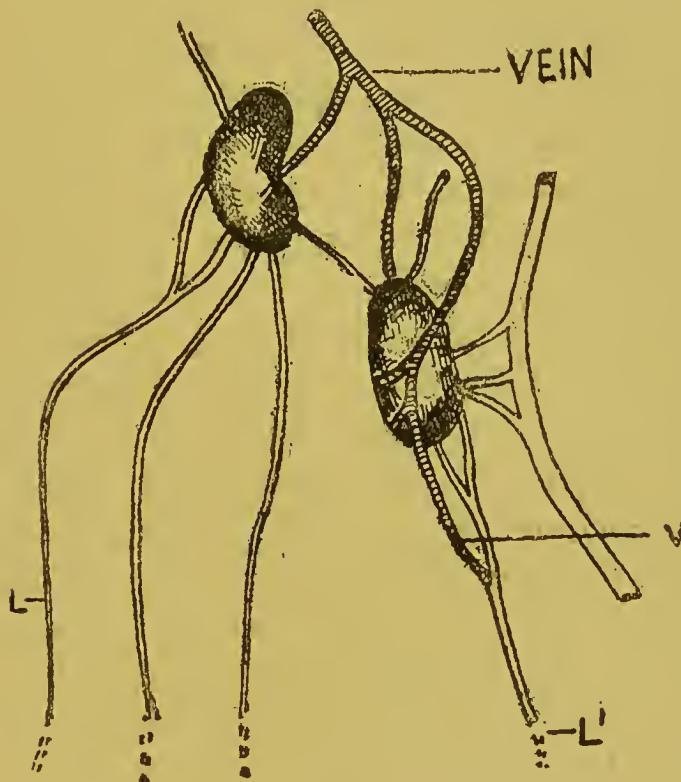


DIAGRAM 1.

Dissection showing two of the superficial inguinal glands with their lymphatic vessels and veins.

glands situated close to the bifurcation of the common iliac artery. By this method of injection the lymphatic vessels are probably rendered distinct by two processes. In the first, some of the

formalin solution undoubtedly passes straight into the lymphatic vessels; the greater part, however, does not, for had it done so these vessels would be found fully distended and the beaded appearance due to the presence of valves quite distinct; this, however, except in the thoracic duct, was not noticeable. In the second process what takes place is probably as follows: The greater part of the formalin solution escapes into the surrounding subcutaneous tissues. This is proved by finding these tissues bathed in the fluid; this fluid by hardening and drying up the fat in which the vessels are embedded and by hardening the vessels themselves from the outside thus renders them distinct.

Diagram 1 brings out an important fact, and that is, that a communication exists in the inguinal region—at any rate, between some of the lymphatic trunks and the smaller veins. In this dissection the vessel L' was traced down the thigh for six inches. It had no naked-eye resemblance to a vein; its walls, like the other lymphatic vessels, were white. This vessel terminated by three branches, two of which passed straight into the gland, while the other terminated in a small vein which on dissection was found to be a tributary passing into the circumflex iliac vein. Sections were taken of the vein at V and of the vessel L'. In the former the walls were found to be very thick, the various coats distinct and sharply marked off from each other. The vessel on transverse section was quite round,

while blood was seen in the interior. The thickness of the walls giving the vessel the appearance of an artery was undoubtedly caused by the excessive amount of formalin used for the injection. On examining the vessel L' under the microscope it was found that the walls were much thinner, that the lumen was oblong (not round), and that the various coats were not nearly so distinct or so well marked off from each other as they were in the vein.

Diagram 2 represents a preparation taken from another subject which had been injected with the usual amount of formalin solution (four pints). For preserving this gland with the lymphatic vessels I am much indebted to Mr. E. J. Wyler of the London Hospital. In this case some of the lymphatic vessels were found unusually distinct. In the diagram the two veins which came from the lymphatic gland were traced to one of the tributaries of the deep external pudic vein. Besides this there was a vessel (L') also coming from the gland which was found to end in the long saphenous vein. This vessel presented the same naked-eye appearance as the vessel L' of Diagram 1. It exactly resembled a small thoracic duct. Though the lumen was larger than that of either of the veins, yet the thickness of its walls was only about a third. Several microscopical sections were made. They showed that the various coats were neither so thick nor so sharply defined as was the case in the veins.

The two vessels L' (in Diagram 1) and L'' (in Diagram 2) are undoubtedly lymphatic vessels. Diagram 1 shows an afferent lymphatic vessel partly terminating in a lymphatic gland and partly terminating in a vein. Diagram 2 shows an efferent

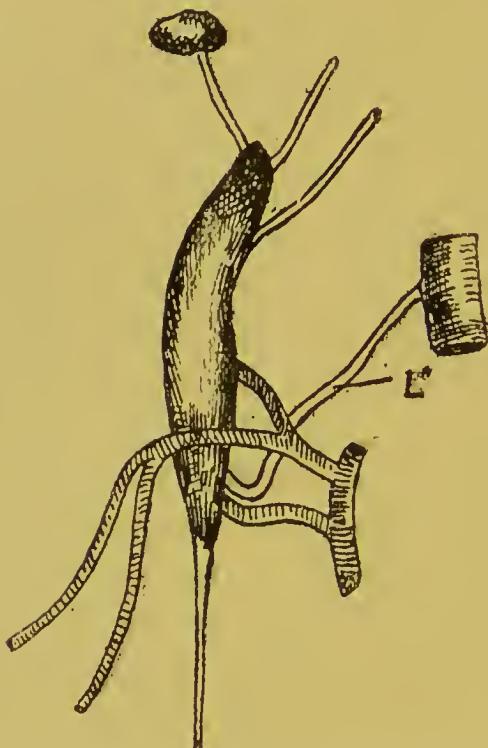


DIAGRAM 2.

Dissection of an inguinal gland showing a lymphatic vessel terminating in a vein.

lymphatic vessel emptying straight into the long saphenous vein. It is well known that a microscopical distinction is not always possible between a vein and a lymphatic. Hence it might reasonably

be inferred that both the vessels shown in this diagram were not lymphatics, but veins. In subjects, however, which have been hardened in formalin, especially if this has been injected in large quantities through the veins, a distinction between any but the smallest veins and lymphatics may be made by noticing the following points of difference :—

Naked-eye Appearance.

Veins.

1. Veins look blue.
2. On section the walls remain apart ; hence
3. The lumen is round.
4. The walls are thick.

Lymphatic Vessels.

1. Lymphatic vessels look white.
2. The walls collapse quickly on section ; hence
3. The lumen becomes obliterated unless a pin is inserted to keep the walls apart.
4. The walls are much thinner.

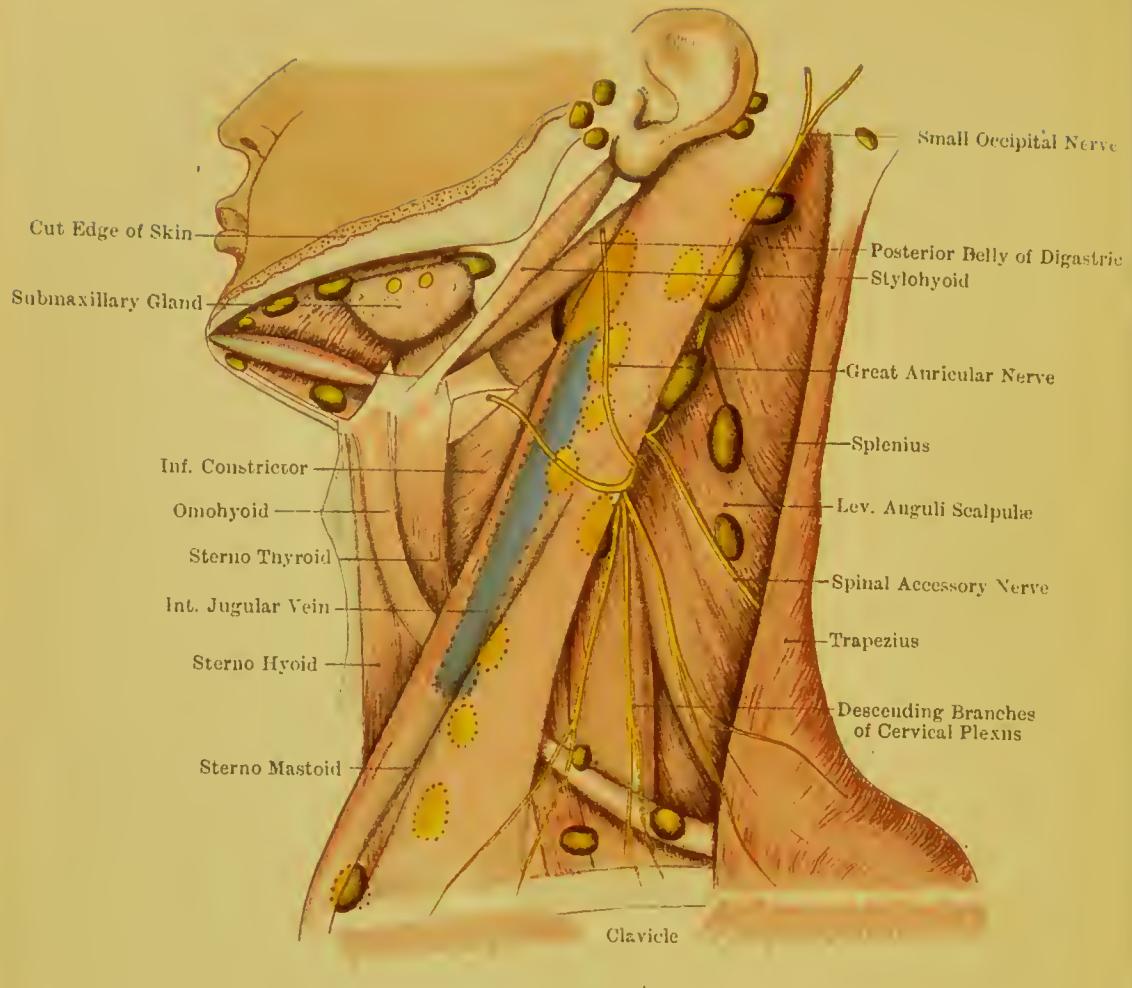
Under the Microscope.

- | | |
|---------------------------------------|---|
| 1. Veins usually contain blood. | 1. Lymphatic vessels usually do not contain blood. |
| 2. The lumen is round. | 2. The lumen is oblong. |
| 3. The various coats are well marked. | 3. The coats are not so thick or so sharply marked off from each other. |

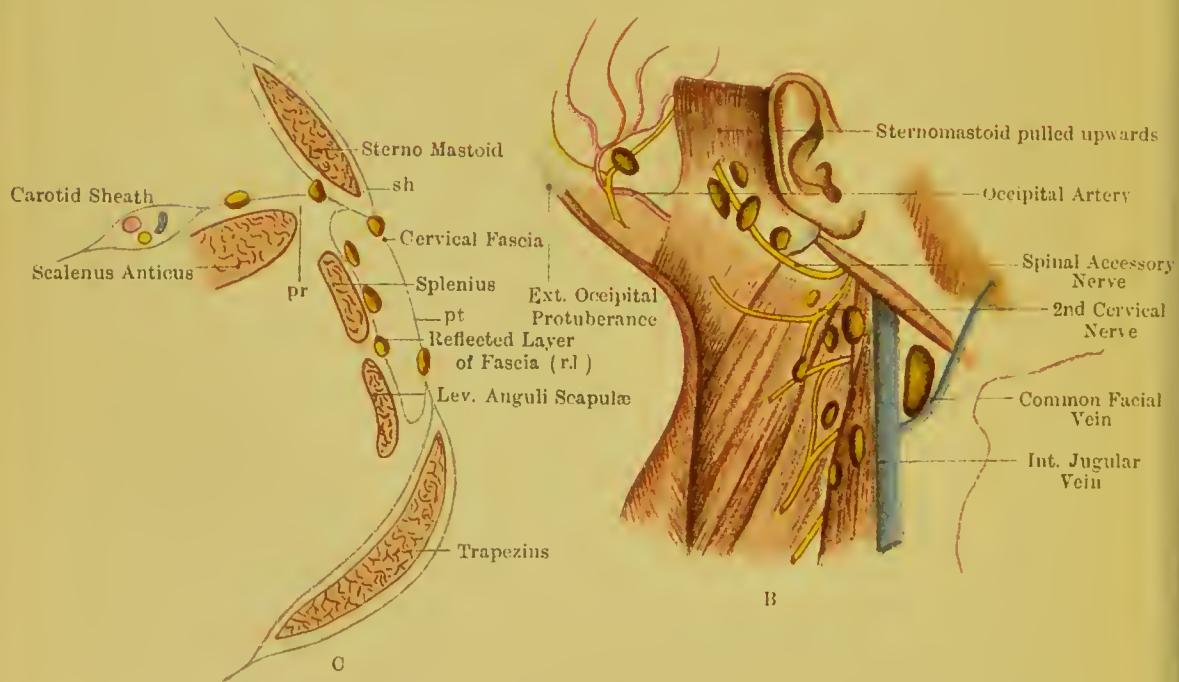
In both diagrams these distinctions were well marked. For lymphatic vessels which communicate in this way with the veins the term "lymphatic vein" might be used. Whether such communications will be found in other parts of the body subsequent dissections will show. In that part of the mesentery which was dissected there was no trace of it,

and even in the inguinal region it was not observed to be at all frequent. Sappey long ago came to the conclusion that there was a direct communication between the finest lymphatic capillaries and the vascular system; but that a communication takes place between the larger lymphatic trunks and the veins other than at the termination of the right lymphatic and thoracic duct respectively has not, I believe, yet been observed. If such a communication is shown to be general throughout the body it may help to explain a good many otherwise obscure clinical phenomena.

It is, therefore, (1) quite possible to render the lymphatic vessels sufficiently plain for dissection purposes by the injection of a large quantity of formalin solution; (2) the fresher the subject the greater the probability of success; (3) as much pressure as possible (short of rupturing the heart or any large vessel) must be used; and (4) in the inguinal region, at any rate, and possibly in other parts of the body, a communication exists between the veins and lymphatic vessels.



A



B

FIG. 1. DISSECTION SHewing LYMPHATIC GLANDS OF HEAD AND NECK.

FIG. I.—THE LYMPHATIC GLANDS OF THE HEAD

may be divided into the following groups :—

A. Occipital. Represented by one small gland the size of a pea, which lies from $1\frac{3}{4}$ to 2 inches from the external occipital protuberance, and in a line drawn from that process to the junction of the upper and middle third of the ear. The gland in the adult is small and lies directly over the great occipital nerve, or between it and the occipital artery; if the trapezius is well developed it lies on the attachment of this muscle to the superior curved line, if not, either on the upper part of the complexus or lowest part of the occipito-frontalis. It is frequently absent, especially in the adult. The glands on each side become much enlarged in children suffering from superficial sores at the back of the head; in such cases they are often very painful, especially when touched, probably owing to the fact that the great occipital nerve becomes compressed against the occipital bone. In *B.* the gland on the right side is shown lying immediately above the complexus upon the occipito-frontalis.

B. Posterior Auricular or Mastoid. Two small

glands lying on the insertion of the sternomastoid to the mastoid process. In the adult this small group, like the preceding, is frequently absent; in the infant it is usually well marked and often represented by one large gland lying in this situation. This group is shown in *A*.

C. Praeauricular or Parotid. Two to six small glands which lie more or less embedded in the substance of the parotid—the more superficial are situated under the parotid fascia immediately in front of the tragus, the rest deeper down. In the foetus these glands are often found quite in the lower part of the parotid. Both in the foetus and adult this group is very constant.

D. Submaxillary. (a) This group consists of two to six glands extending along the lower border of the jaw from the symphysis to the angle. Of these the more anterior rest on the mylohyoid muscle immediately beneath the mandible, the more posterior are embedded in the submaxillary gland—one or more large glands being found between the submaxillary salivary gland and the hyoglossus muscle. The glands situated nearer the angle are larger than those situated more anteriorly: the former can generally be felt in health, the latter never. In removing the glands in this region for epithelioma of the tongue, the submaxillary salivary gland must be well examined both on its superficial and deep aspect. Unless this gland is pulled well down and outwards from

under cover of the jaw, those glands situated near the angle may escape detection and consequent removal. *A.*

(b) Immediately beneath the symphysis between the two anterior bellies of the digastric, a small gland—the submental—is occasionally found, and a larger one—the suprathyroid—lying further back, immediately above the hyoid bone; both these lie close to the medium raphé of the mylohyoid muscle, and are somewhat inconstant. The latter gland is often found enlarged from superficial sores about the lips; its position above the hyoid bone should be remembered, because an enlarged thyrohyoid bursa, with which it might be confounded, will be found projecting below that bone.

E. Anterior Jugular. One to three small glands are occasionally found lying over the anterior jugular vein; most usually, however, they are absent. Testut mentions one or two small glands which lie over the cricothyroid membrane, which he terms *prælaryngeal*.

F. Buccinator. One or more glands have been described which lie on the buccinator muscle, but their presence is most inconstant.

G. Internal Maxillary. Quain describes a few glands which follow the course of this artery beneath the ramus of the jaw. They are only exceptionally present. The only member of this group which I have yet observed was one which I found behind the frontal process of the malar bone,

lying immediately over the extreme anterior end of the upper head of the external pterygoid muscle.

Testut has observed one small gland in the nasolabial fold of the right side of the face in a woman aged thirty, and he mentions that a few small glands may occasionally be seen along the course of the facial vein.

THE LYMPHATIC GLANDS OF THE NECK.

In nearly all the text books of anatomy the glands of the neck are divided into two chief groups, viz., Superficial and Deep. The distinction, however, is artificial and incorrect, because (1) the superficial glands are rarely present. (2) There are a certain number of glands which lie along the posterior edge of the sternomastoid which cannot strictly be relegated to either group. (3) All the glands of the neck are deep in the sense that they are embedded in some part of the deep cervical fascia.

The following may be distinguished :—

1. *Sternomastoid*. This group, both in the foetus and adult, is most constant; it is represented by eight or more glands, varying in size from a pea to an almond, which lie along the posterior edge of the sternomastoid muscle. In the upper part of the neck the glands lie partially under the muscle, and partially project into the posterior triangle; in the lower part, they lie almost entirely under the muscle and join the internal jugular set: one is frequently found lying between the two heads of the sternomastoid muscle. *A.*

2. *Internal Jugular*. Six to twenty large glands which follow the course of the internal jugular vein.

In the adult these glands, which are nearly always well marked, are in the foetus poorly represented. Belonging to this group is one large gland which lies behind the posterior belly of the digastric; it partially rests on the internal jugular vein, being found in the angle between this and the common facial vein; so constant is it in position that anatomically it might well be called the jugulo-digastric gland. It is shown in *A* and *B*. The former diagram shows its relation more especially to the sternomastoid, underneath which it lies almost entirely; the latter its relation to the common facial vein. In health this gland is not readily felt; in certain affections of the tonsil and back part of the tongue, however, it becomes greatly enlarged, and then can be readily felt, owing to the fact that it then comes to project considerably in front of the anterior border of the sternomastoid. The centre of the gland is usually situated half an inch below and somewhat internal to the angle of the jaw. In the usual descriptions no distinction is made between the internal jugular and sternomastoid groups, both being included under the common name of deep cervical.

Included in the internal jugular group there are three or more glands which are very constant in position; they lie over the insertion of the splenius capitis muscle, entirely under cover of the upper end of the sternomastoid; they surround the spinal accessory nerve before it perforates the sternomas-

toid; so intimate is this relation that it is usually impossible to thoroughly expose this part of the nerve unless these glands are entirely removed. Enlargement of these glands would seriously compress the nerve against the transverse process of the atlas. *B.*

The remaining glands of this group lie for the greater part on the outer side of the internal jugular vein, and are in close relation to the cervical plexus as it rests upon the levator anguli scapulæ and scalenus medius. *B.*

3. *Posterior Triangular.* This group consists of four or more glands which may be large, but are usually small: they lie on the splenius and levator anguli scapulae. Some members of this group are nearly always present. *A.*

4. *Omohyoid or Supraclavicular.* Three to six glands lying on the omohyoid muscle or in the sub-clavian triangle. They are somewhat inconstant in number, and owing to their deep position can never be felt unless they are enlarged. Mascagni, in his classical work on the Vasi lymphatici, has a good diagram (Tab. XXVI. Fig. 1) in which he represents some of the lymphatic vessels passing from the inner, anterior, and upper aspect of the chest wall to the supraclavicular glands. It is no uncommon experience in certain, usually advanced, cases of malignant disease of the breast to find these glands much enlarged; if this is the case, anything in the nature of a radical operation is

contraindicated, because this enlargement points with certainty to the fact that the adjacent pectoral muscles and thoracic walls have become infected.

5. *Retropharyngeal.* Two oval glands are sometimes found lying on the rectus capitis anticus major—one on either side of the middle line; they lie above, and internal to the glossopharyngeal nerve as it hooks round the stylopharyngeus muscle. Should these glands suppurate they give rise to a retropharyngeal abscess.

The remaining glands found between the trachea and oesophagus will be described later on.

Some small glands, four to six in number, usually termed superficial, have been described by nearly all anatomists as following the course of the external jugular vein, and lying on the face of the sternomastoid muscle. These glands, however, are very rarely seen in the dissecting room, but it does sometimes happen, more especially in the foetus and in children, that a few glands belonging to the mastoid group previously described may reach lower down than usual, to about the level of the lobule of the ear, but in the adult this is most unusual. On the other hand, it is by no means uncommon to find clinically a chain of enlarged glands which maps out fairly accurately the course of the external jugular vein; this may be accounted for by the fact that in such cases there is either an actual increased formation of glandular tissue, or else that some members of the parotid,

sternomastoid and supraclavicular glands, by becoming enlarged and overlapping the muscle, give the impression of a chain of glands following the vein.

Though some of the glands of the head and neck are situated nearer to the surface than others, yet they are all deep in the sense that they are embedded in some part of the deep cervical fascia, and for this reason it would be better to discontinue the terms Superficial and Deep. By a reference to *C*, which represents a transverse section taken across the upper part of the neck of a foetus, the relation of the lymphatic glands to the deep cervical fascia may be seen. This fascia is attached to the external occipital protuberance and superior curved line and to the spines of the cervical vertebræ; from these points it passes forwards, enclosing the trapezius muscle, after which it sweeps across the posterior triangle of the neck (*p t*) and then forms a sheath for the sternomastoid muscle (*s h*). As it crosses the posterior triangle it gives off a reflected layer (*r l*) on to the muscles which form the floor of the posterior triangle (splenius, levator anguli scapulæ, and scalenus medius) either in the layer *p t* or *r l*, or in both (they are to some extent adherent to each other), the glands of the posterior triangle are found embedded.

From the inner side of the sheath of the sternomastoid muscle a layer (*p r*) passes over the scalenus anticus muscle, and uniting with the pre-

vertebral layer forms the carotid sheath. Embedded in the layer (*p r*) are found the internal jugular glands. The sterno-mastoid glands lie partially in this layer and partially in the deep cervical fascia where it is about to split to form the sheath for the sternomastoid muscle. The occipital and posterior auricular glands lie in that part of the deep cervical fascia which forms the superficial part of the sheath of the trapezius and sternomastoid muscles.

From the above description it will be seen, that as the majority of cervical glands lie partially or entirely under the sternomastoid, and in close relation to the cervical plexus and internal jugular vein, their satisfactory removal involves a difficult, and usually hazardous operation, if this is conducted in the usual way; especially when it so frequently happens that the glands are closely matted to each other, and adherent to the vein.

From operations made on the dead subject, I am convinced that (1) the danger to the vein is best avoided by thoroughly exposing it. This is accomplished by partially dividing the sternomastoid muscle. (2) The satisfactory removal of glands can be effected only by taking away in as thorough a manner as possible the cervical fascia in which they lie embedded.

For the removal of glands under the upper half of the sternomastoid and in the upper half of the posterior triangle, the following operation

is easily performed, and in the dead subject gives very satisfactory results, in so far as the glands within the area of operation are freely exposed and can be entirely removed :—

A vertical incision is made midway between the anterior and posterior of the sternomastoid, commencing about the level of the lobule of the ear and carried downwards to the centre of that muscle. From the upper part of the first a second incision is made, which at first passes directly backwards for an inch, and then downwards, following a line half-inch posterior to the anterior border of the trapezius muscle. The skin being well reflected, the sheath of the sternomastoid is exposed and divided along a line following the first incision. Before the sheath is opened at the lower part the great auricular nerve and external jugular vein will be easily recognised—both must be preserved. The sheath is now peeled off the posterior and under surface of the muscle, which is now to be hooked well forwards. From the whole of the upper part of the floor of the posterior triangle the cervical fascia is now cautiously peeled off. It is best to commence at the edge of the trapezius, and divide the fascia below. As the fascia is being peeled off, the spinal accessory nerve must be looked for: if it is not well isolated there is a strong probability that it will be accidentally divided. The spinal accessory nerve enters the sternomastoid about one inch

below the mastoid process emerges from the posterior border about its centre, and then disappears under the trapezius on a level with the sixth or seventh cervical spine (Godlee).

The sternomastoid is now partially divided by a cut made transversely from behind forwards, on a level with a point one inch below the level of the lobule of the ear. By pulling the now partially divided muscle still further forwards, the surgeon can easily see the posterior belly of the digastric, the bifurcation of the common carotid artery, and the hypoglossal nerve. The glands lying over the internal jugular vein are well exposed. The fascia running under the sternomastoid is now divided as close to the vein as is consistent with safety, and the whole of the cervical fascia, which has thus been isolated is removed, together with the glands contained in it; these may be found to number twenty-two or more. The only difficulty in this operation lies in avoiding the spinal accessory nerve. The small occipital nerve and some of the descending cutaneous branches of the cervical plexus will probably be cut through, otherwise no important vessels or nerves will be injured.

In the lower part of the posterior triangle a similar operation on the dead subject, in so far as the glands are thoroughly removed, gives excellent results, but on the living greater risks would be run, for (1) the glands lie relatively much

deeper; (2) there would be some risk of air entering the external jugular vein, which must necessarily be cut; (3) owing to the deeper position of the muscles which form the floor of the lower part of the posterior triangle, the fascia is more difficult to peel off satisfactorily, and as it is stripped off from the scalenus anticus muscle there is a danger of wounding or cutting the phrenic nerve.

FIG. II.—CERVICAL AND THORACIC LYMPHATIC GLANDS.

In this dissection, which was made by Messrs. Ellis and Pitt, both the clavicles have been removed, together with the majority of costal cartilages. The lungs are drawn outwards, the reflections of pleura forming the anterior mediastinum are shown.

Cervical. The glands of the head and neck which were not described in the previous section are represented by two groups.

A. Œsophago-tracheal. Three or more glands situated between the trachea and the œsophagus. Usually they are found to be more numerous and better marked on the left than on the right side; on the left side especially they come into very close relation with the recurrent laryngeal nerve.

B. Inferior Thyroid. Three or four glands which follow the course of the inferior thyroid artery. The lowest of these is found to the inner side of the scalenus anticus; the middle in the concavity formed by the inward bend of the artery; the upper, which are very fairly constant in position,

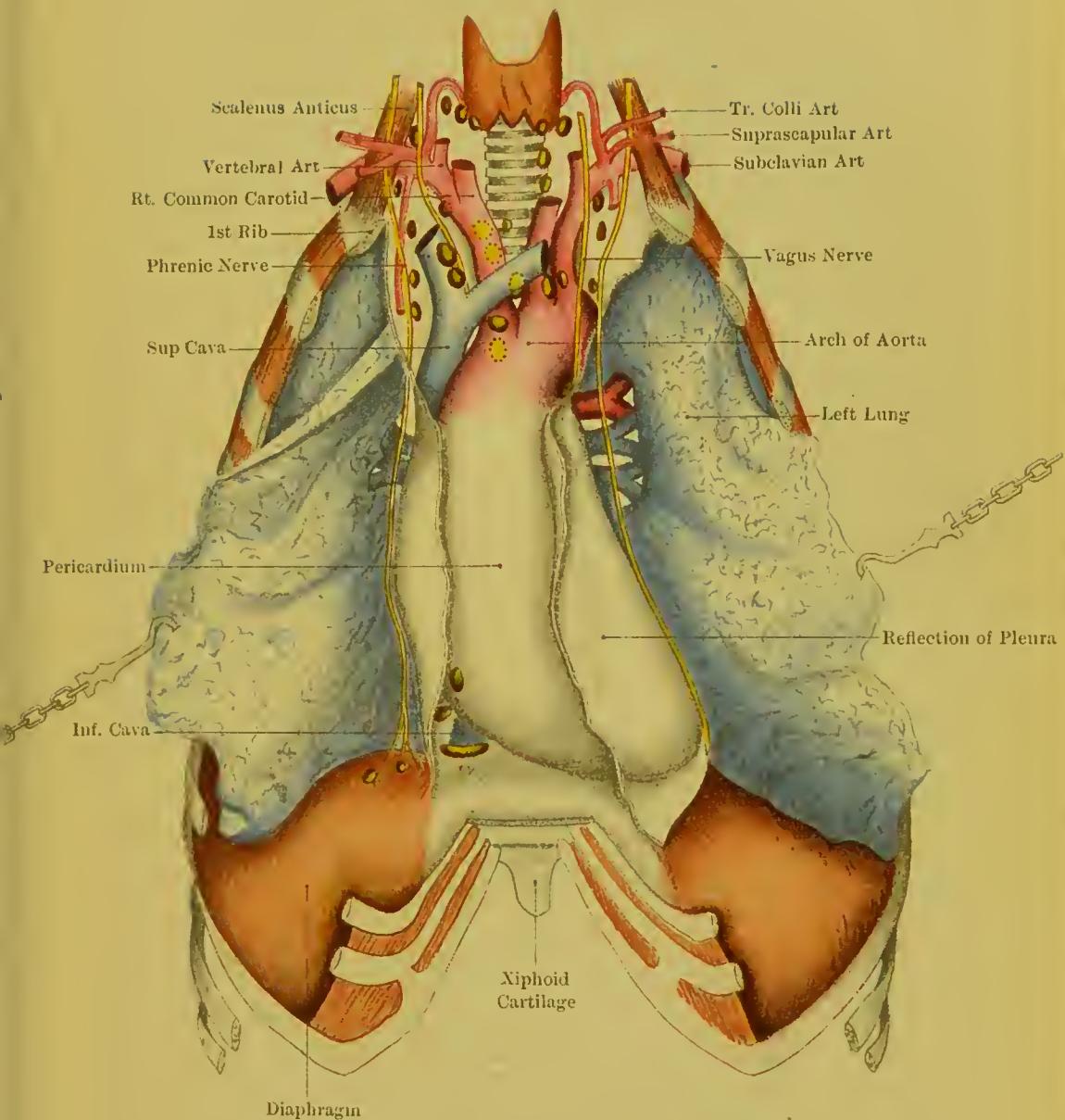


FIG. II. DISSECTION SHewing SOME OF THE MEDIASTINAL AND CERVICAL LYMPHATIC GLANDS.

either on or close to the lower surface of the thyroid gland.

Thoracic. The Thoracic glands are here classified, as is the most usual custom, according to the spaces in which they are found. The following groups are met with:—

1. *Superior Cardiac.* This group may be taken to include those glands situated between a line drawn from the highest point of the first part of the subclavian arteries above, to the base of the heart below. In this group are—

(a) Three or more small glands which follow the phrenic nerve and internal mammary artery; they are situated close to the origin of the artery from the subclavian, and lie on the pleura. After the nerve has crossed to the inner side of the artery they lie to the inner side of the nerve: as a rule these glands do not extend lower down than the level of the root of the lung, and often not as far as this.

(b) Three or more glands lie in close relation to the first part of the subclavian artery on either side; they are usually found between the artery and the pleura.

(c) Several glands are situated between the left innominate vein in front, and the innominate, left common carotid and subclavian artery behind. These are constantly found, especially between the left common carotid and subclavian arteries; and vary in size from a pea to an almond. In addi-

tion, three or more glands are sometimes found lying over or below the left innominate vein; and two or more often lie over the right innominate vein, but they are somewhat inconstant.

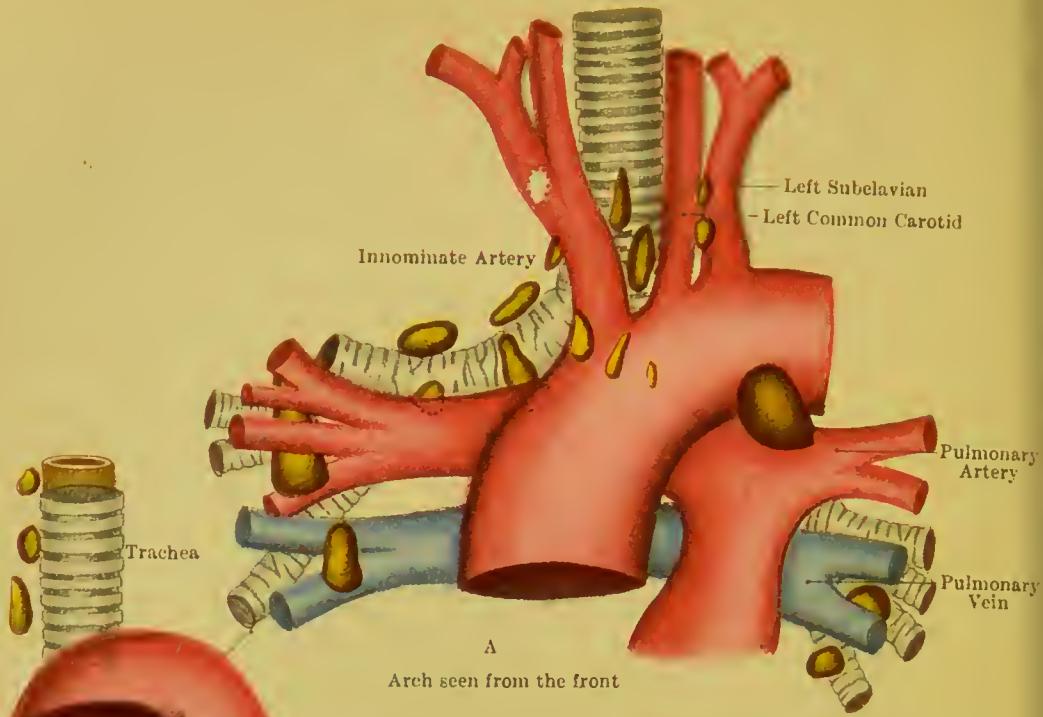
Glands also surround the innominate arteries, one or more being found on its anterior, but the greater number on its posterior surface, between it and the trachea; some of the glands in front of the latter lie immediately behind the commencement of the right common carotid artery.

(d) One or two large glands are found between the pericardium and under surface of the transverse arch. This group is always present, and the gland or glands composing it are large and round and come into intimate relation with the left recurrent laryngeal nerve.

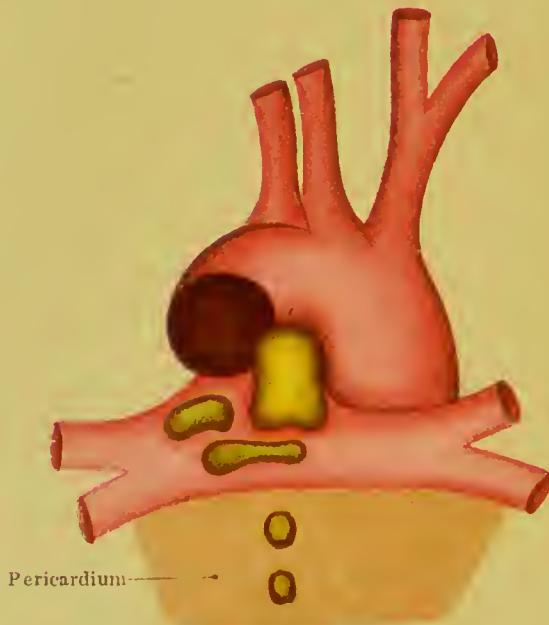
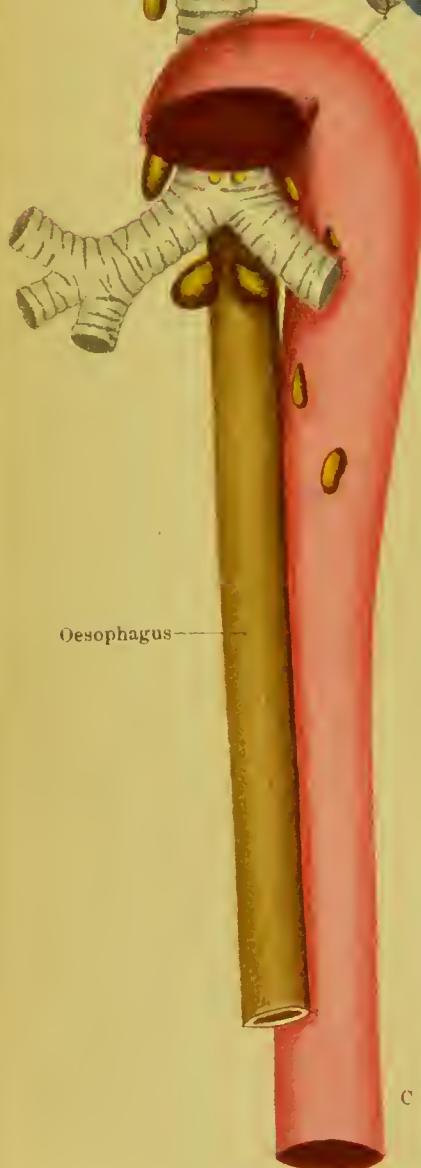
2. (e) *Anterior Mediastinal.* This group is represented by usually not more than two glands situated in the lower part of the anterior mediastinum. They are shown in the figure close to the cut edge of the right pleura, which has been separated from its fellow of the opposite side; the other glands which are thus exposed lying close to the termination of the phrenic nerve, and the inferior cava are described further on with the glands of the diaphragm.

FIG. III.

3. *Middle Mediastinal.* The glands of the middle mediastinum may be taken to include those which



A
Arch seen from the front



B
Arch seen from behind

C

FIG. III. DISSECTION SHewing LYMPHATIC GLANDS IN RELATION TO ROOT OF LUNG AND ARCH OF AORTA.

are grouped round the roots of the lungs. This group consists of large glands, which for the most part are wedged in between the pulmonary artery, bronchi and pulmonary veins. It is not unusual to find two or more glands entirely in front of the roots of the lungs: the actual size and number of these glands are by no means constant. Three or more large glands are usually found lying on the upper surface of the right and left bronchi: they are more numerous in the former than the latter situation. These, as well as the superior cardiac glands mentioned in the previous section, are seen in *A*.

Fig. *B* shows three large glands situated on the posterior surface of the pulmonary artery, while below, two glands are seen lying behind the pericardium—belonging to the œsophago-pericardial group to be described later on.

Fig. *C* shows two large glands which are constantly found immediately below the bifurcation of the trachea; they are sometimes replaced by a single larger gland. Dr. Frederick Batten, in the St. Bartholomew's Report, vol. xxxi. page 183, has pointed out that in children the glands most liable to tubercular infection are those situated under the bifurcation of the trachea, and he mentions the fact that they have sometimes been found to ulcerate into the right bronchus. In four cases, moreover, he found that the same caseous gland which had ulcerated into the right bronchus had

also ulcerated into the œsophagus; this condition can readily be understood when it is remembered that the bifurcation glands lie also in front of the œsophagus. The fact of the greater liability of the right bronchus to be perforated by a caseous gland may be explained by the greater number of glands which are usually found lying over the right bronchus.

The glands shown in *C*, with the œsophago-pericardiac group, and a few scattered glands lying in front of the descending thoracic aorta, constitute all the glands in the posterior mediastinum.

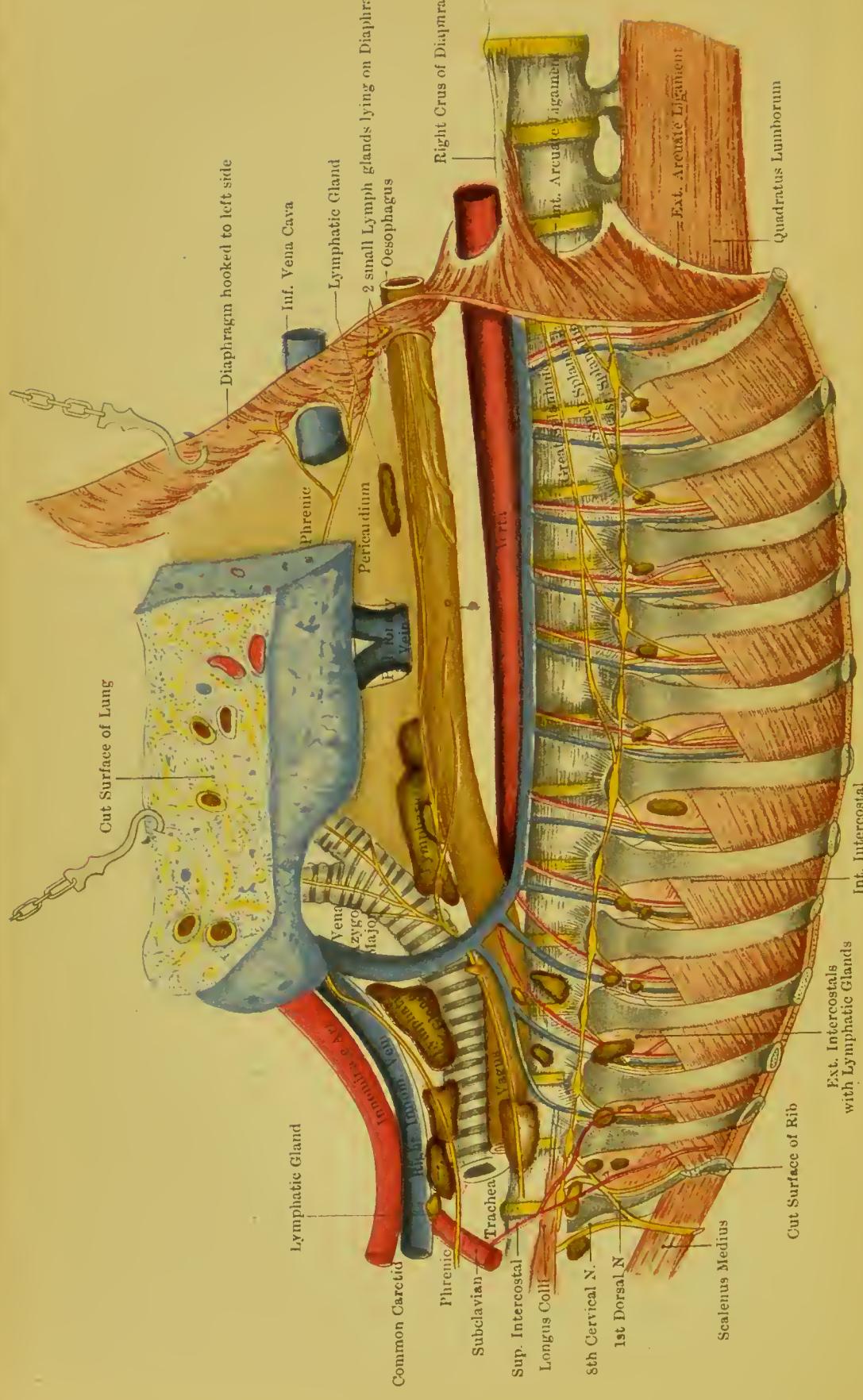


FIG IV. DISSECTION OF RIGHT SIDE OF THORACIC DRAINING LYMPHATIC GLANDS

FIG. IV.—THORACIC GLANDS—*continued.*

This and the following dissection was made in a subject in which there was found tubercular disease of the right lung; though the diagram shows the glands much enlarged, yet it indicates clearly the positions they normally occupy. In this dissection the greater part of the right lung was cut away leaving only a large stump, the pericardium was incised, and the heart and stump of the lung pulled up, and as far as possible to the left side; in the diagram the transverse arch of the aorta is not represented.

The groups shown in this figure are—

4. *Intercostal.* One or more oval-shaped glands situated in each intercostal space: there is usually one gland for each space, but it is not uncommon to find two or three. They lie almost entirely on the external intercostal muscle, and are not as a rule found further outwards than the posterior extremity of the internal intercostal muscle; occasionally, however, they lie on this muscle. For the most part they lie between or slightly external to the heads of the ribs, and in very close relation to each ramus *communicans*. In

the upper part of the thorax the glands tend to lie somewhat high in each space; in the lower part slightly lower down. The intercostal nerves and arteries pass as a rule under the glands, but this relationship, as the figure shows, is somewhat variable.

As a subdivision of this group to which no distinctive name need be given, may be mentioned three or more glands which follow the trunks of those veins which drain the second, third and fourth intercostal spaces, and which empty themselves into the vena azygos major as it hooks round the root of the lung; these are usually found.

5. *Posterior Mediastinal.* This group is represented by four or more glands usually the size of an almond. They are situated between the posterior surface of the pericardium and oesophagus, and may be termed oesophago-pericardiac. Three or more glands are situated above the level, and two or more below the level of the pulmonary vein. This group is a direct continuation of that which is found both in the neck and upper part of the thorax between the trachea and oesophagus. In the diagram, owing to the stump of the lung being pulled upwards, the glands between the trachea and oesophagus are represented as lying somewhat too far forwards instead of in the groove between these two organs. This group lies in very close relation to the trunk of the vagus and its oesophageal branches.

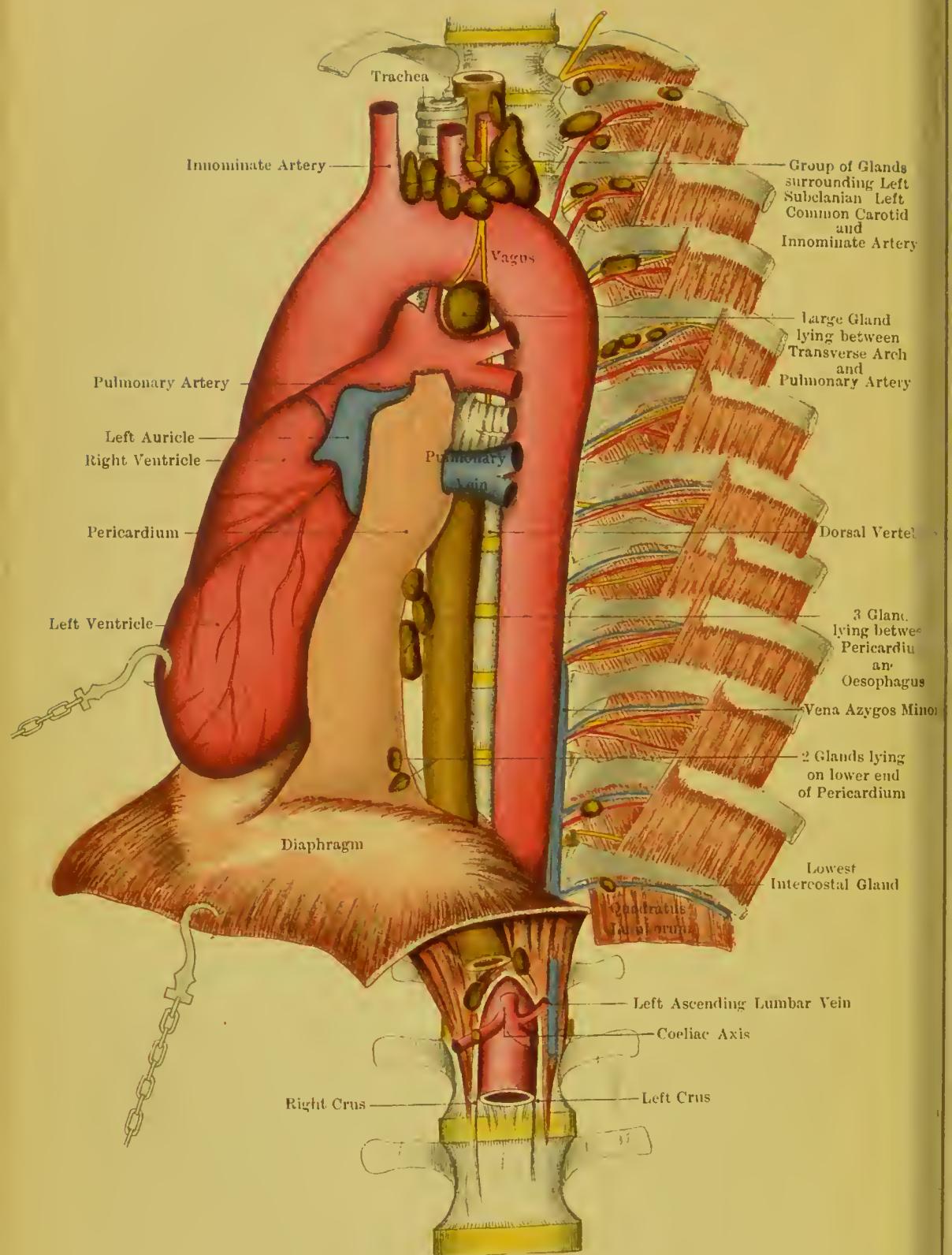


FIG V. DISSECTION OF LEFT SIDE OF THORAX SHewing LYMPHATIC GLANDS.

FIG. V.

The glands of the thorax previously mentioned are here shown on the left side; the heart and that part of the diaphragm which has not been cut away are pulled to the right side. It will be seen that the glands between the innominate, common carotid, and left subclavian artery are particularly large. The exact position of the gland under the transverse arch, lying in the angle between the pulmonary artery and ductus arteriosus, is shown; whilst its intimate relation with the left recurrent laryngeal nerve is also seen. Three of the posterior mediastinal glands are represented lying between the oesophagus and posterior aspect of the centre of the pericardium. Two glands are also shown lying on the lower end of the pericardium. The intercostal glands are shown, but none were present in the sixth, seventh, eighth, ninth or tenth spaces.

FIG. VI.

6. *Sternal.* This group is sometimes entirely absent. In others it is represented by sixteen or more glands. Those most constantly present are found in the upper three spaces; they rest on the inner aspect of the internal intercostal muscle in close relation to the internal mammary artery, and to its perforating, anterior intercostal, and sternal branches. In the fourth and fifth spaces the glands are frequently absent; if present they may be found lying either on the costal cartilages, or on

the back of the sternum, or in the spaces further out between the ribs.

One or two glands may be found in the sixth interspace, or on the back of the upper part of the xiphoid cartilage, while a very large gland is often found either in the sixth interspace or on the seventh costal cartilage between it and the diaphragm.

The sternal glands may become affected in those cases of scirrhous of the breast which spread to its inner part. In such instances there would be little difficulty in removing them from the upper three spaces, through an incision similar to that for ligaturing the internal mammary artery; in the lower spaces, however, such a proceeding would be inadvisable, owing to the frequent absence and variable position of these glands.

FIG. VII.

7. Diaphragmatic. In this figure the thorax is shown in transverse section, with the upper surface of the diaphragm exposed. The ribs and the lower end of the sternum are cut through, and the latter with the xiphoid cartilage pulled forwards. The reflexions of pleura, forming the anterior, middle, and posterior mediastina are shown. The glands on this aspect of the diaphragm may be divided into the following groups.

(a) *Anterior diaphragmatic.* One or two medium-sized glands lying on either side of the diaphragm

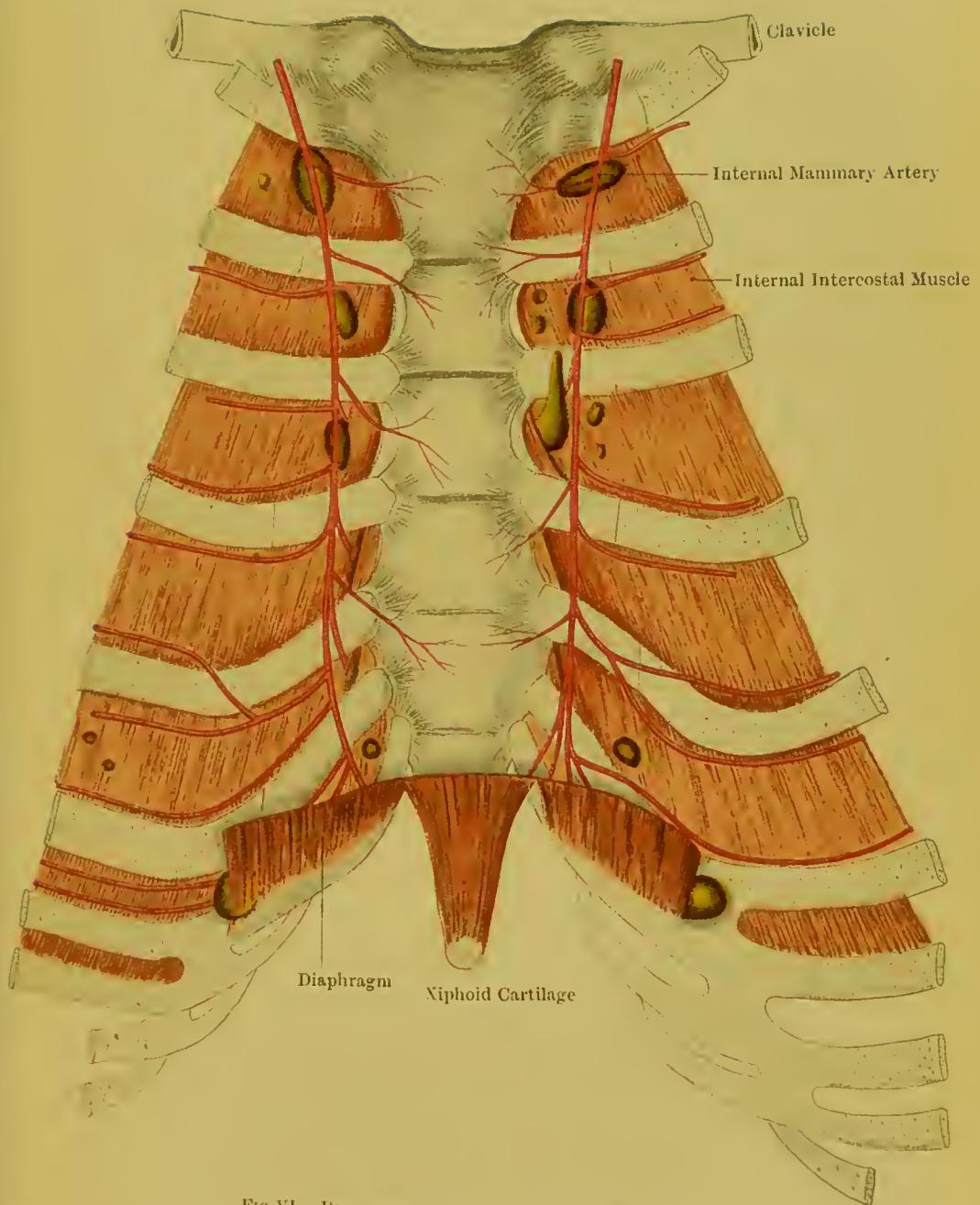


FIG VI. DISSECTION SHEWING STERNAL LYMPHATIC GLANDS.

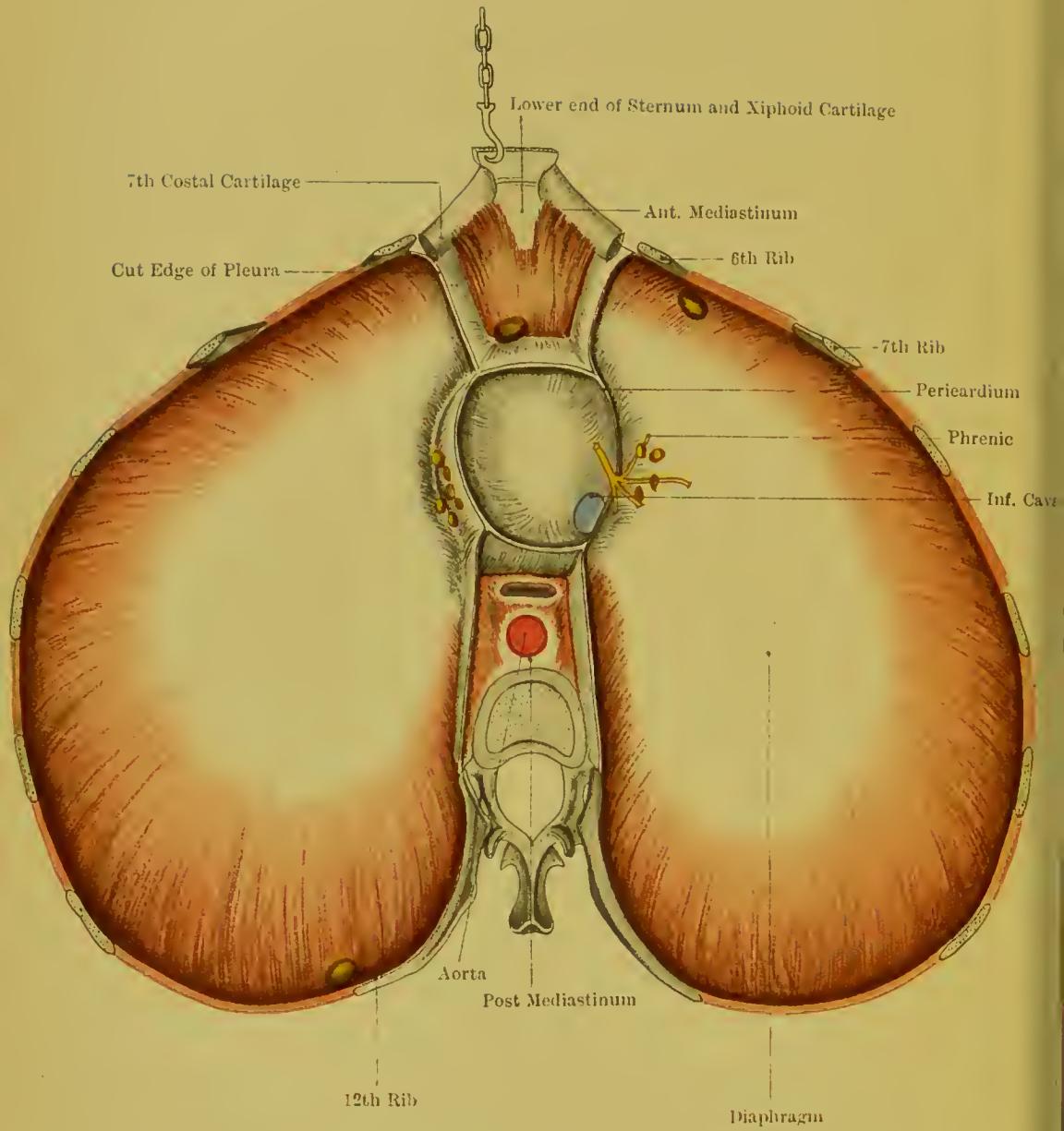


FIG. VII. DISSECTION SHewing LYMPHATIC GLANDS ON UPPER SURFACE OF DIAPHRAGM.

close to the anterior extremity of the seventh rib. In the diagram, the gland on the right side only is represented; another gland—the lowest of the anterior mediastinal group previously mentioned, is also shown lying on the anterior aspect of the diaphragm.

(b) *Posterior diaphragmatic.* A gland situated on the posterior part of the diaphragm, on a level with the twelfth rib, is represented on the left side only; this is inconstant. One or two small glands are frequently found close to the oesophageal opening; they lie in the posterior mediastinum; but they are often absent, and are not shown in the figure.

(c) *Central-diaphragmatic.* An oval-shaped gland is very frequently found lying immediately in front of the inferior vena cava, after this vessel has perforated the diaphragm. This gland is shown in Fig. 2.

(d) *Phrenico-diaphragmatic.* Three to six small glands found over the terminal filaments of the phrenic nerve. This nerve breaks into its terminal filaments slightly above the diaphragm, and these filaments perforate the diaphragm for the most part to the right side of the caval opening. It is around these filaments that this small group of glands is found. On the left side this group is found partly on the diaphragm and partly on the lower end of the pericardium.

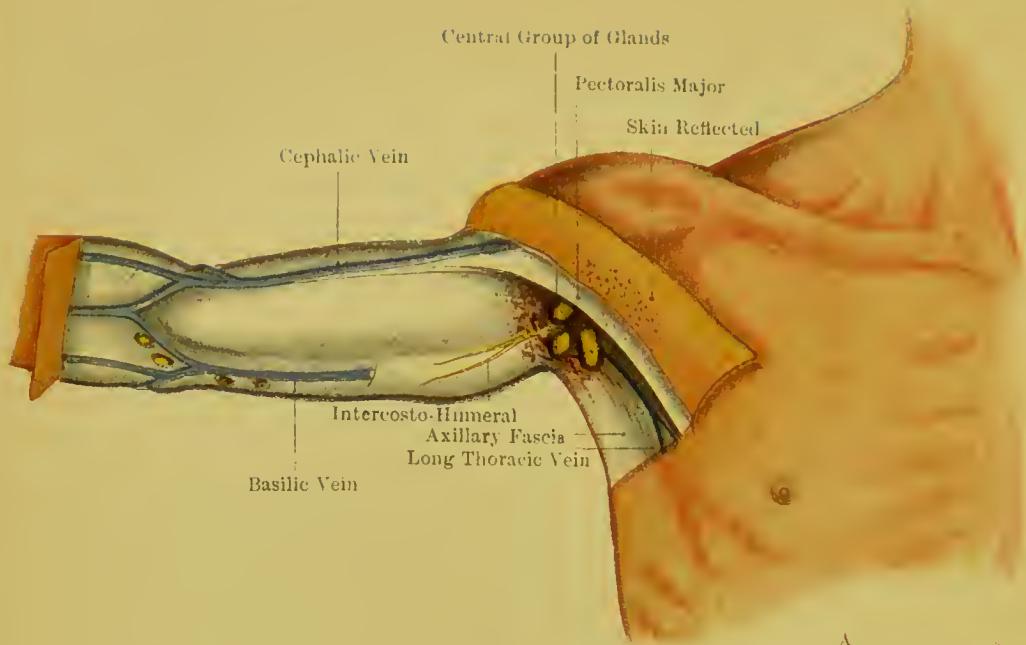
Sappey, in Fig 1, Plate XLIII. *Vaisseaux Lym-*

phatiques, represents three glands, situated on the anterior aspect of the diaphragm—two on the left and one on the right side. He represents two on either side of the œsophageal opening and six about the aortic orifice. These glands correspond to the groups I have named anterior and posterior dia-phragmatic.

Mascagni, Tab. XXVI. Fig. 1, represents one large gland on the right anterior surface of dia-phragm: he shows none on the left side.

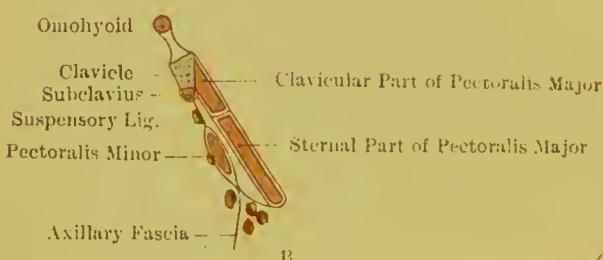
Testut thus describes these diaphragmatic glands : “Four to six rest on the convex surface of the muscle; one generally finds two to three at the level of the base of the pericardium, and one or two around the quadrilateral orifice which gives passage to the inferior vena cava.”

Central Group of Glands



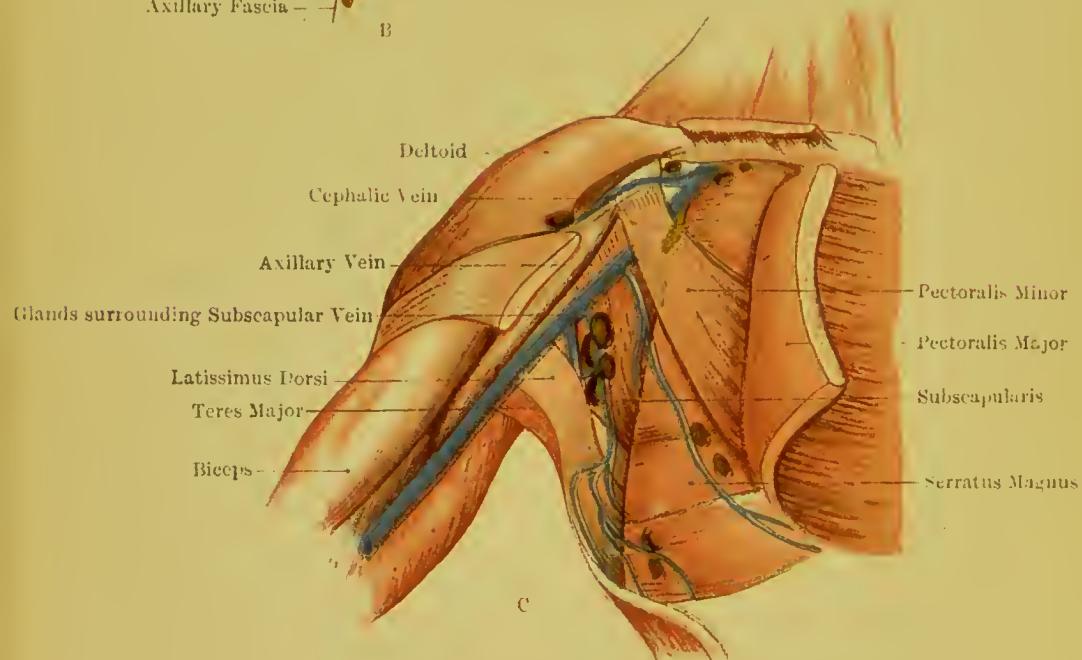
A

Omohyoid



B

Deltoid



C

FIG. VIII. DIAGRAMS SHewing ARRANGEMENT OF LYMPHATIC GLANDS IN ARM AND AXILLA.

FIG. VIII.—LYMPHATIC GLANDS OF THE AXILLA.

From the frequency with which the lymphatic glands of the axilla have to be removed in cases of malignant disease of the breast, it becomes most important first of all to establish the exact anatomical position of these glands, and secondly to determine the relation they bear to the pectoral and axillary fascia.

The various groups which are *constantly* found in the axilla may be thus classified.

A. Central. Three to four large glands, usually as large as almonds, embedded in the axillary fascia.

B. Subscapular. Three or more large glands lying over the dorsalis scapulæ, and over the termination of the subscapular vein. This group lies in the quadrilateral space.

C. Pectoral. One or more small glands, lying to the inner side of the axillary vein behind the centre of the pectoralis minor.

D. Infraclavicular. A few small glands lying on the serratus magnus, immediately below the clavicle to the inner side of the axillary vein.

The *less constant* groups consist of—

1. Two or more small glands lying on the com-

mencement of the subscapular vein as it rests on the serratus magnus.

2. A few glands lying along the lower border and costal origin of the pectoralis minor. Very occasionally one or more glands may be seen between the pectoralis minor and major.

3. A gland called the Cephalic is found in the groove between the pectoralis major and the deltoid ; it may lie immediately below the clavicle, or $1\frac{1}{2}$ inches lower down to the outer side of the axillary vein.

The central group of glands is shown in *A* ; the remaining groups in *C*.

By a reference to *B* it will be seen that the pectoral fascia is attached above to the clavicle, and then forms a sheath for the great pectoral muscle, while below it blends with the axillary fascia—a process passing from the front to the back of the sheath separates the clavicular from the sternal portion of the muscle.

The lymphatic glands and vascular structures of the axilla are contained in a four-sided pyramid of connective tissue, the blunt apex of which is continuous above with the fascia descending from the posterior surface of omohyoid behind the clavicle. Externally it is attached to the axillary vein ; posteriorly it rests on the subscapularis ; internally it becomes continuous with the fascia covering the serratus magnus, while its base is formed by the axillary fascia ; the connective tissue which forms the pyramid is loose and areolar.

A much thicker and better defined portion of this four-sided pyramid, known as the suspensory ligament, may be regarded as forming its anterior surface. This, as shown in *B*, is attached to the clavicle above, enclosing the subclavius muscle; it forms a sheath for the pectoralis minor, and lower down blends with, and slings up, the axillary fascia: before doing this, it frequently opens out, and with the axillary fascia forms a little pocket in which the central group of glands lie embedded.

The axillary fascia frequently presents an opening which is very similar to the saphenous opening of the thigh. This was originally described by Poirier.¹ Over this opening and to its margins a quantity of fat is found, in which lie embedded the group of glands, to which, seeing that it lies midway between the anterior and posterior folds of the axilla, the name of Central is given. The opening is in some cases represented by much attenuated fascia stretched between stronger bands; in some cases it is absent altogether. This Central group bears a somewhat variable relationship to the axillary fascia, more or less dependent upon the presence or absence of this axillary opening. If the opening is present, the glands are found in the fat in and around the margins of the opening, or in the pocket as above described; the opening frequently transmits the intercosto-humeral nerve and long thoracic vein, both of which, as they emerge through the

¹ *Le Progrès Médical* 1888, pp. 68-71.

opening, come into close contact with this group of glands.

Should no opening be present, the glands may then be found either on the superficial or deep aspect of the axillary fascia ; in the latter case they form, with the subscapular, one large group, and any distinction which may be drawn between the two is quite artificial. It is to this Central group of glands we generally refer when we speak of enlarged axillary glands. The inner margin of the axillary hair, midway between the anterior and posterior folds of the axilla, forms a good superficial landmark to this group of glands.

If no axillary opening is present, and these glands lie on the superficial aspect of the axillary fascia, they can best be felt by pressing them against the unyielding fascia, with the arm in the adducted position ; if, on the other hand, an opening is present, they may most easily be detected by adducting the arm, and so relaxing the fascia and pressing them against the thoracic wall : in examining, therefore, for enlarged glands in the axilla, the arm should always be placed in both these positions.

The presence of this opening readily explains the ease with which axillary abscesses come to the surface, and the proximity of the intercosto-humeral nerve the pain which may be experienced in cases of enlarged axillary glands.

The suspensory ligament is important not only from the share it takes in slinging up the axillary

fascia, but also because in it are found embedded the infraclavicular, pectoral, and some part of the subscapular group of glands ; this relation is shown in *B*. In this figure, which is diagrammatic, the opening up of the suspensory ligament forming the pocket above described is seen, and within it is enclosed the Central group of glands. The subscapular group is seen resting partly on the axillary fascia, and partly on the lower end of the suspensory ligament, the pectoral and infraclavicular group are also shown—the former, behind the pectoralis minor, the latter between it and the clavicle.

This description of the suspensory ligament, and its relation to the lymphatic glands, holds good in most instances. In some cases, however, a quantity of fat is found between the posterior surface of the pectoralis minor and the suspensory ligament, and in this fat the pectoral glands may be embedded. In other cases the suspensory ligament, in addition to sending a well-marked process which helps to form the sheath for the axillary artery, is connected by loose fat with the pectoral branches of the acromio-thoracic artery, and in this the pectoral group of glands may be embedded ; the part which actually forms the posterior part of the sheath of the pectoralis minor being in these cases so thin as to be almost imperceptible.

In Fig. IX. the relation which the suspensory ligament and axillary fascia bear to the lymphatic glands is represented as seen in dissection. It will

be noticed that no axillary opening is really present, but that over the place where the Central group of glands are situated the axillary fascia is much attenuated, so that a potential opening is formed. The pocket formed by the opening out of the suspensory ligament is very large. The subscapular group is represented in this case by a solitary gland. Both the more and less constant pectoral groups are shown, the infraclavicular glands in this case being absent.

In his book on *Cancer Operations, their Objects and Limits*, Mr. Watson Cheyne lays great stress on the necessity of removing the whole of the axillary tissue in one piece, in cases of scirrhus of the breast, because it minimizes the risk of healthy structures being infected during the progress of the operation. There is also a strong anatomical reason why this should be done; for if the suspensory ligament and axillary fascia be removed in one piece, all the glands which are embedded in them will be removed also; this I have verified many times in the post-mortem room. Moreover, some of the glands, especially the less constant groups, namely those found along the lower and inner end of the pectoralis minor and along the commencement of the subscapular vein, are sometimes so small and so embedded as to render their detection an impossibility to the naked eye: these would inevitably escape removal if the operation was conducted in the usual way.

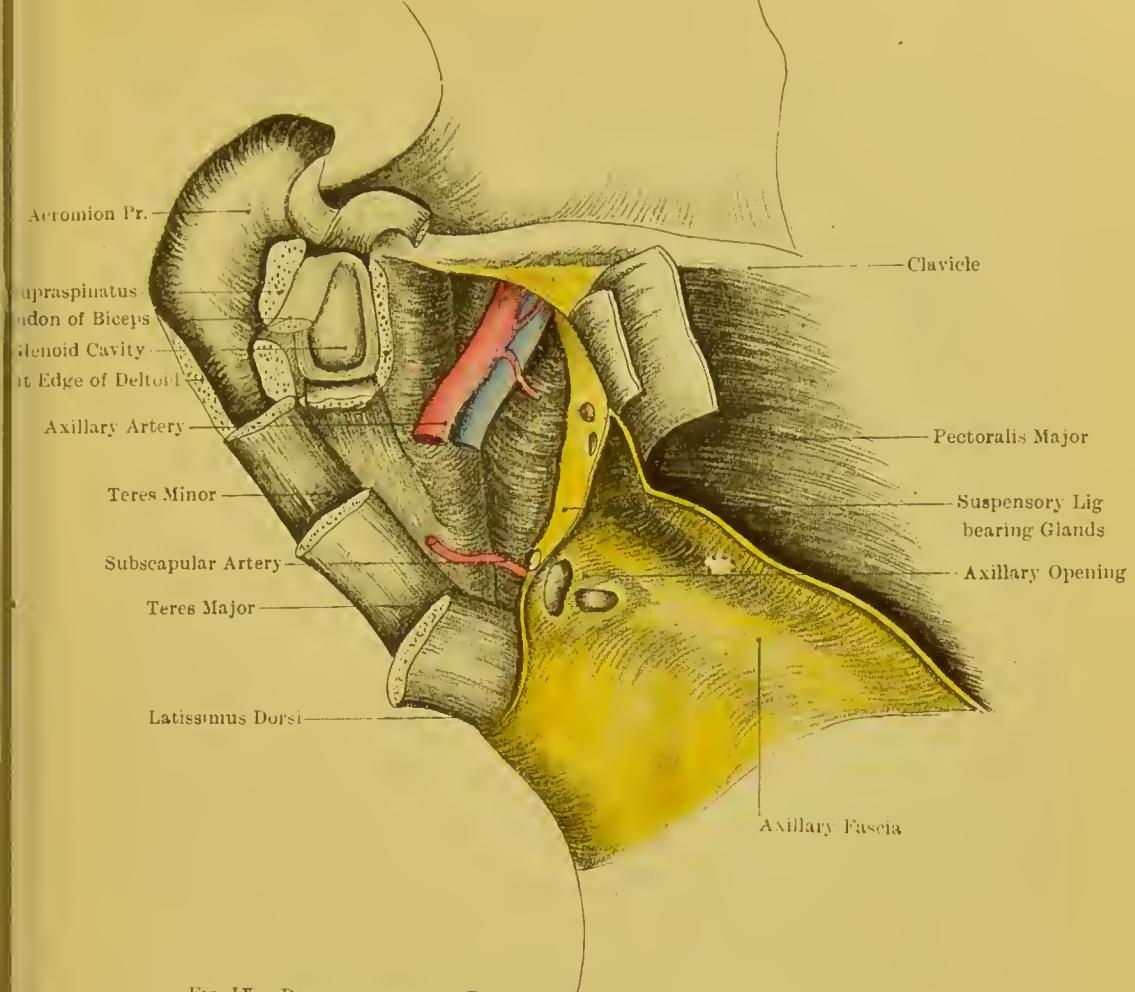


FIG. IX. DISSECTION SHEWING RELATION OF GLANDS TO AXILLARY FASCIA, &c.

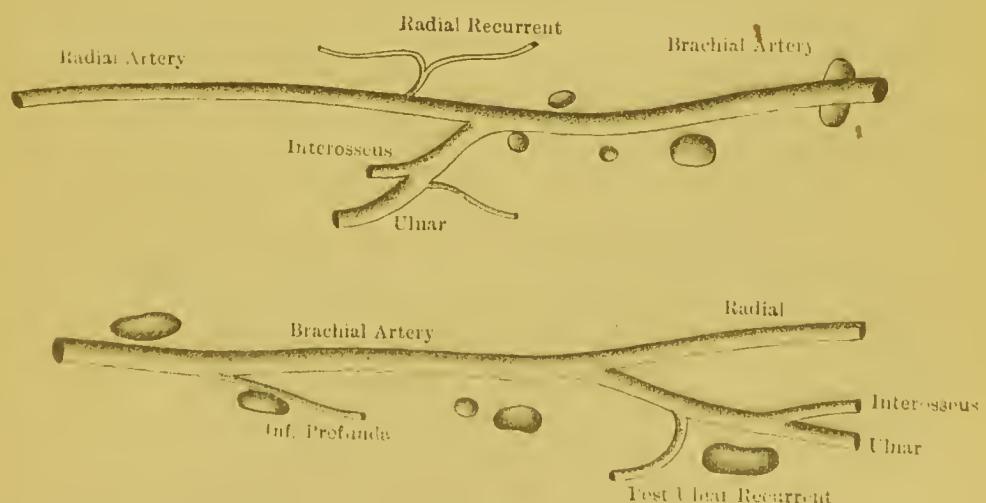


FIG. X. DISSECTION SHEWING GLANDS OCCASIONALLY FOUND ON BRACHIAL ARTERY.

To the above rule, however, three exceptions must be made.

(a) It occasionally happens that one member of the subscapular group projects considerably backwards, in which case the gland, which is often quite small, can only be seen when the back is dissected ; it is then found between the teres minor and infraspinatus muscles. Should this gland be present it would not be removed by the above operation.

(b) Some members of the infraclavicular group may be found lying to the outer side of the axillary vein ; this is not usually the case however, but if it were so, and as the suspensory ligament must be stripped off the inner side of the vein, it is obvious that these glands would remain behind.

(c) In all cases the cephalic gland (which in *A* is represented in both of the positions it may possibly occupy) would be unaffected by the operation, but it could easily be removed separately.

In order to insure the removal of the suspensory ligament in one piece it is necessary to remove with it the greater part of the pectoralis minor, because this muscle is so adherent to that part of the ligament which forms a sheath for it.

The antecubital glands (A) are variable in number ; frequently none are present. Most usually a small gland is found $1\frac{1}{2}$ inches above and slightly to the outer side of the internal condyle ; this is of all the antecubital glands the most constant. Often a gland is found below this, $\frac{3}{4}$ to 1 inch above the

internal condyle. Both these glands are usually superficial to the deep fascia, but occasionally lie underneath it. Two small glands are occasionally seen lying over the median basilic vein. In one case a gland was found in the antecubital fossa lying to the inner side of the brachial artery, on the brachialis anticus underneath the deep fascia and 2 inches above the internal condyle.

Somewhat different accounts have been given of the axillary glands by anatomists. Professor MacAlister, page 260, Fig. 370, thus describes them : " Embedded in these tissues there are usually twelve lymphatic glands—three lie along the lower edge of the great pectoral, one close to the humerus receiving the cutaneous brachial lymphatics, and one intermediate receiving mammary and superficial thoracic lymphatics ; two lie above these behind the great pectoral, and receive the lymphatics of the areola and nipple ; two overlie the costocoracoid membrane close to the cephalic vein, receiving the lymphatics from the shoulder ; and three rest on the axillary vein receiving the deep brachial lymphatics : one upon the subscapular artery behind collects the lymph vessels of the hinder wall of the cavity, and one lies on the latissimus dorsi close to the scapular quadrilateral space. The efferent lymph vessels from these ascend on the axillary vein, having crossed the artery, and enter the neck by four trunks."

Theile and Blandin noted the presence of glands lying superficial to the axillary fascia, while Testut denied their presence as a normal condition ; there is no doubt, however, that the glands which in the above description are called Central, do often lie superficial to the fascia, but in a great many cases, however, they cannot be correctly described as being either superficial or deep to it ; as they lie in the loose fat about the axillary opening, and it is often found that one half of a gland belonging to this group projects on the deep, while the other half projects on the superficial aspect of the fascia. Hence the discrepancies in these two accounts can be easily reconciled.

Testut gives an excellent description of the axillary glands. He says, "The glands of the axilla are placed for the most part in front of and internal to the artery and vein ; along the length of these vessels a true chain is formed, which extends uninterruptedly from the inferior border of the pectoralis major to the outer border of the first rib. Independently of these glands, which might be termed satellite glands of the artery, one constantly meets with two other groups, viz., Antero-internal and Posterior."

"*Antero-internal* (which correspond to those glands which are described as being somewhat inconstantly found at the inner and lower border of the pectoral muscles) are buried in the internal or thoracic side of the axilla, in the lower part of

the recess between the great pectoral and the serratus magnus muscles.

"Posterior. Three or four glands are situated behind and in front of the vasculo nervous space, close to the lower border of latissimus dorsi and subscapular artery."

(These correspond with the group described as subscapular.)

The following glands have been described in abnormal situations :—

A. Two or three have been observed by Testut along the course of the brachial artery.

B.¹ Glands have been observed by Dubois following the course of the radial, ulnar, and interosseous arteries.

Fig. X shows dissections taken from the right and left arm of the same subject. On the right side five glands were found more or less in close contact to the brachial artery. On the left four were present; a large gland was also found between the ulnar artery and its posterior ulnar recurrent branch. All these glands were placed beneath the deep fascia, the Venæ comites in this case being unusually well developed and joining the basilic vein low down. It is very unusual to find so many glands in relation to the brachial artery; but one or two glands about the level of the internal condyle, or $1\frac{1}{2}$ to 2 inches above it, lying under the deep fascia, are not uncommonly met with.

¹ Soc. Anat., 1856.

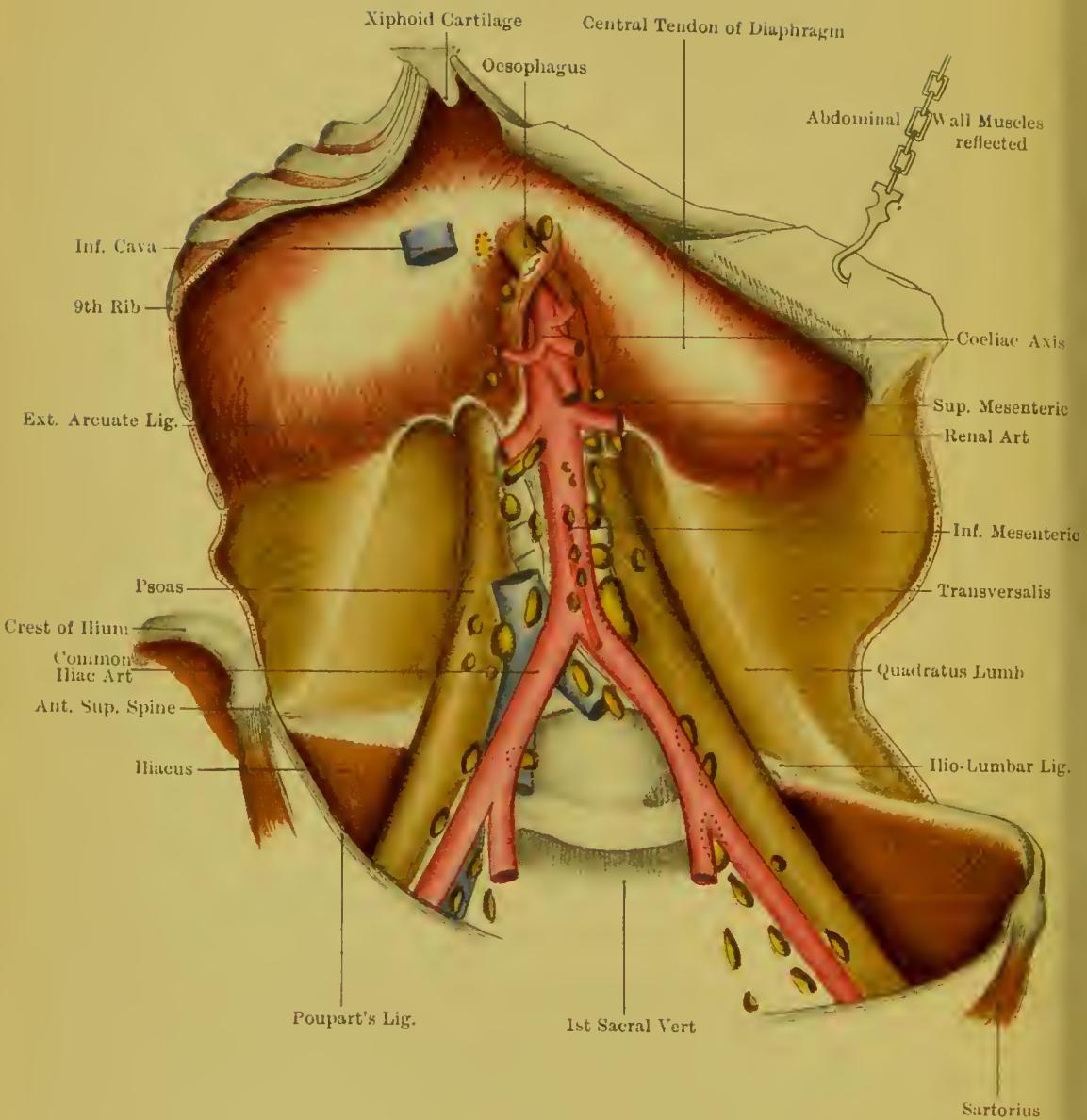


FIG. XI. DISSECTION SHOWING LYMPHATIC GLANDS OF THE ABDOMINAL AORTA.

FIG. XI.—AORTIC AND SUBDIAPHRAGMATIC GLANDS.

This diagram represents the lymphatic glands on the under surface of the diaphragm and those in connection with the abdominal aorta. On the under surface of the diaphragm two or more glands are usually seen close to the right or left side of the œsophageal opening, and three or four more farther back situated slightly in front of the aortic opening. One small gland, which is dotted in the diagram, is shown close to œsophageal opening on the upper surface of the diaphragm. It will be noticed that all the glands on the under surface of the diaphragm are placed quite close to the middle line. The glands in relation to the abdominal aorta may be divided into a *Mesial* and *Lateral* set.

The *Mesial* may be divided into the following groups :—

A. Cœliac. One or more glands are sometimes found lying over the trunk of the cœliac axis, but they are by no means constant. The chief glands are found not round the trunk itself, but round the branches which spring from it.

B. Superior Mesenteric. In this group also very few glands are found actually on the origin of the

artery, the majority of them being found lower down in the mesentery.

C. Inferior Mesenteric. Four or more small glands which lie over the aorta and partially surround the inferior mesenteric artery.

The *Lateral* groups are generally large and numerous, the most constant being—

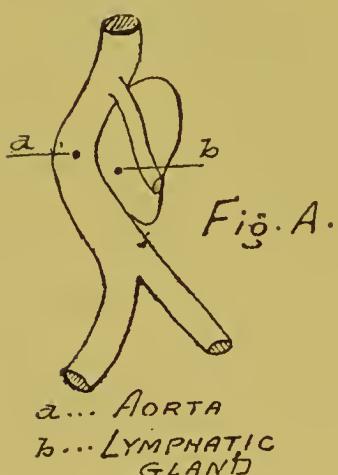
1. *Internal Arcuate.* Two or more glands which lie over the internal arcuate ligament on one or both sides.

2. *Renal.* This is a well-marked and constant group, consisting of three or more large glands situated under the renal vein, in the angles between the abdominal aorta and renal arteries.

3. *Lateral Aortic, or Lumbar.* Seven or more large glands situated on either side of the aorta and lying on the vertebrae; these are rather more marked on the left than on the right side. It is not uncommon to find an extremely large gland

lying to the left side of, and partially projecting under, the lower part of the abdominal aorta and commencement of the common iliac artery.

In dissecting-room subjects a peculiar curve is occasionally seen in the lower part of the abdominal aorta (Fig. a). This curve usually



presents a well-marked convexity to the right and a corresponding concavity to the left side. The large gland just mentioned is often found lying in the concavity, but apparently it does not cause it, as the curve may be present when the gland is absent. It would appear that the curve in question is caused by a downward drag on the inferior mesenteric artery. As the artery passes downwards and to the left, it is clear that if it were drawn downwards it could produce a bend in the aorta with the convexity to the right. Such a downward pull on the artery might easily be caused by an habitually overloaded sigmoid flexure or rectum coupled with a weakened resisting power of the coats of the aorta. In one case the walls of the artery were found to be very atheromatous. On the right side the lateral aortic group lie for the most part entirely under cover of the inferior cava ; three or more glands, however, are often found lying on its anterior surface—this is usually the case at the commencement of the cava.

4. *Antero Psoal.* Three or more small glands lie on the anterior surface of the psoas muscle. One of these is often seen in close relation to the ovarian or spermatic vein shortly before it terminates in the cava or left renal vein.

5. *Postero Psoal.* This set, though not belonging to the lateral group, may be considered here. It consists of a few small glands which are placed between the transverse processes of the lumbar

vertebræ and the psoas muscle. They are most inconstant, and are not represented in the diagram.

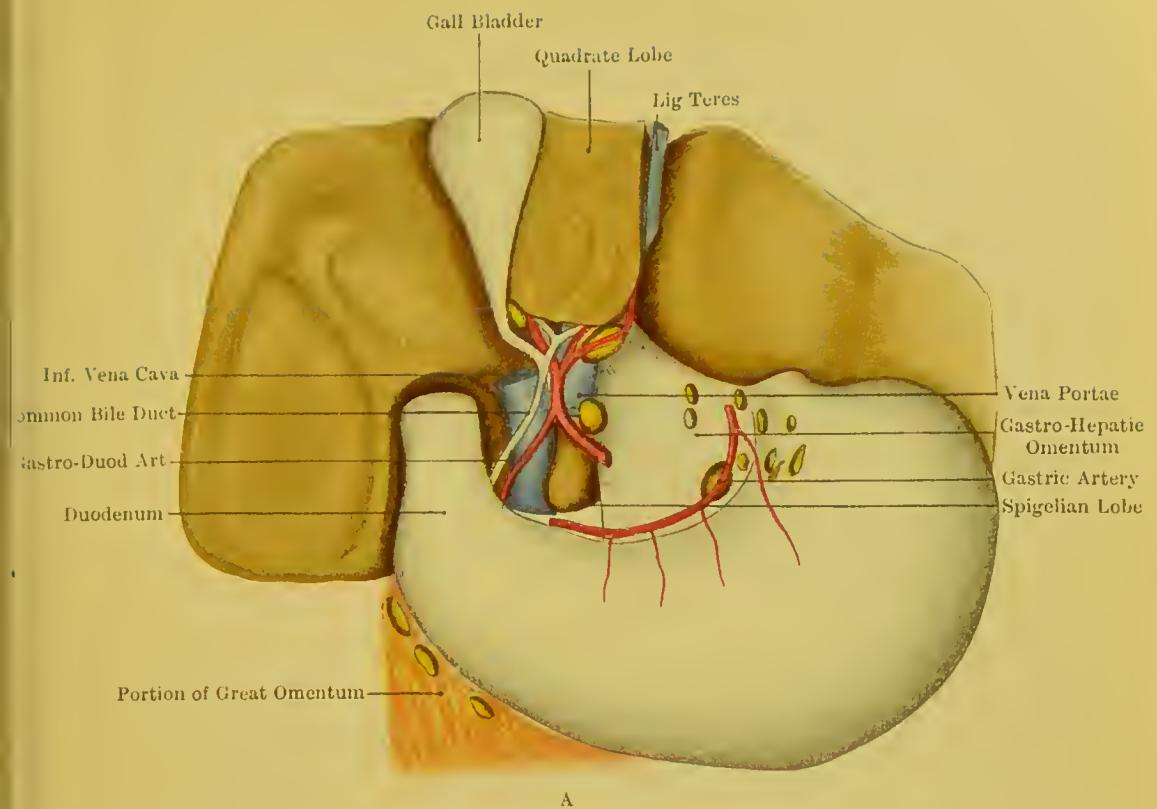
Mascagni, Tab. XIX., represents three to four glands lying along the hinder part of the crest of the ileum and ileolumbar ligament. He shows also a few glands lying on the anterior surface of the quadratus lumborum. Both these groups are, however, very rarely present.

FIG. XII.

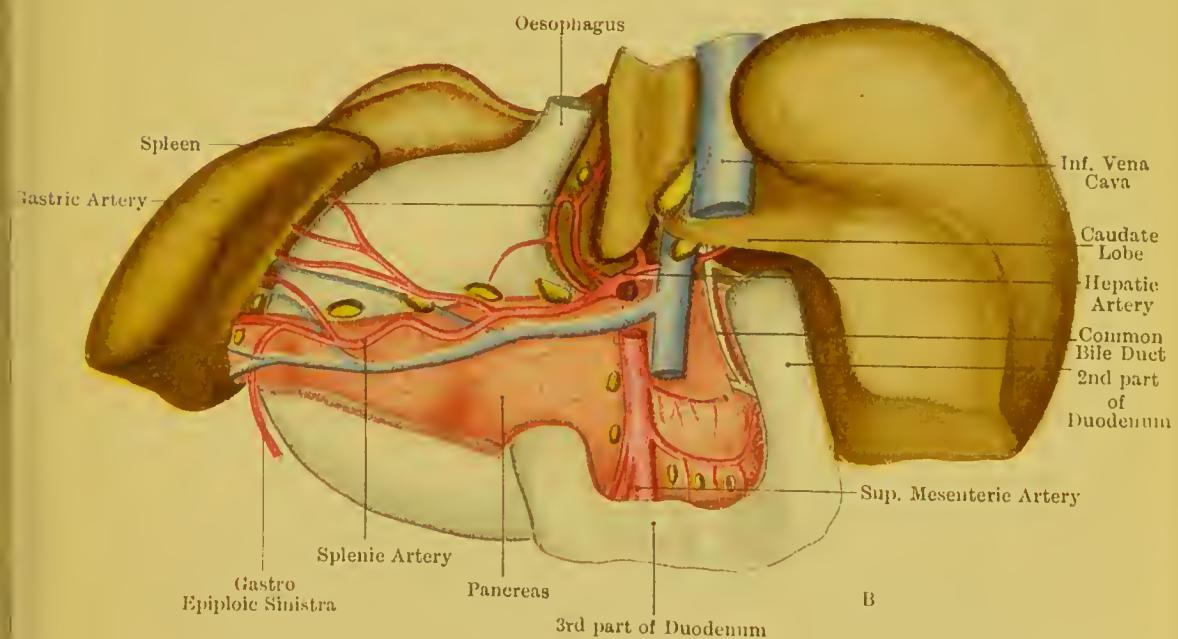
This represents the lymphatic glands of the Stomach, Pancreas and Spleen.

A. The lymphatic glands of the *Stomach* consist of two groups. Three to ten glands which follow the course of the gastric artery ; the first gland of this group is usually found where the vessel makes a sudden bend downwards to course along the lesser curvature of the stomach, and is situated between the termination of the oesophagus and the left margin of the Spigelian lobe. The remaining glands are situated partly in the gastrohepatic omentum and partly on the anterior surface of the cardiac end of the stomach.

B. This group usually consists of two to three glands situated in the great omentum immediately below the pyloric end of the stomach ; they lie over the right gastro-epiploic artery. In some cases fifteen or more glands may be seen in the great omentum following the omental branches from the two gastro-epiploic arteries ; the majority



A



B

FIG. XII. DISSECTIONS SHewing LYMPHATIC GLANDS OF LIVER, STOMACH, PANCREAS, AND SPLEEN.

of these glands are found between the greater curvature and upper end of the transverse colon, but some lie over the transverse colon and some extend slightly below its lower border. It is not usual, however, to find such a number of glands in this situation. The glands in both these groups, *A* and *B*, may become extensively affected in cases of carcinoma of the pylorus.

C. The lymphatic glands of the Spleen and Pancreas consist of three groups of 4–5 large glands which follow the course of the splenic artery. These are situated immediately behind the upper end of the pancreas. This group is very constant.

D. Four or more smaller glands situated in the hilum of the Spleen. Some of the lower members of this group are situated close to the commencement of the left gastro-epiploic artery, but they do not follow the course of that artery for any distance along the great curvature of the stomach.

E. Two or more glands lie to the left-hand side of the superior mesenteric artery as it descends between the head and what is known as the lesser pancreas. This artery, in addition to the inferior pancreatico-duodenal branch, which is given off in front of the third part of the duodenum, often gives off two branches; these run outwards in the form of loops, from which twigs are distributed supplying the head of the pancreas and duodenum. It is between the twigs formed by the lower of these two loops that two or more small lymphatic glands are usually

found. In position they correspond with the glands found between the primary or secondary loops of the *vasa intestini tenuis*. These branches, which may also arise from the hepatic or splenic artery, may be termed middle or posterior pancreatico-duodenal; they add very materially to the blood supply of the head of the pancreas and lesser pancreas.

Three or more glands are sometimes found extending from the tail to the head of the pancreas, lying against the posterior surface of the centre of the pancreas. They are not constant however.

The lymphatic glands of the *Liver* are somewhat variable, the most usual groups consisting of—

A. Portal. Three or more glands which follow the *venæ portæ* to the transverse fissure of the liver. Of this group the most constant is one found partially projecting underneath the Caudate lobe, and lying partly over the portal vein and partly over the right branch of the hepatic artery.

B. A group consisting usually of only a single gland, which is found between the Spigelian lobe and the fissure for the inferior vena cava. This gland is seldom present: should it enlarge it is obvious that it might cause serious pressure on the inferior cava.

C. This group, like the preceding, usually consists of a single gland, and like it, is inconstant. It lies between the cystic and hepatic duct. It is important to note the position of this gland, however,

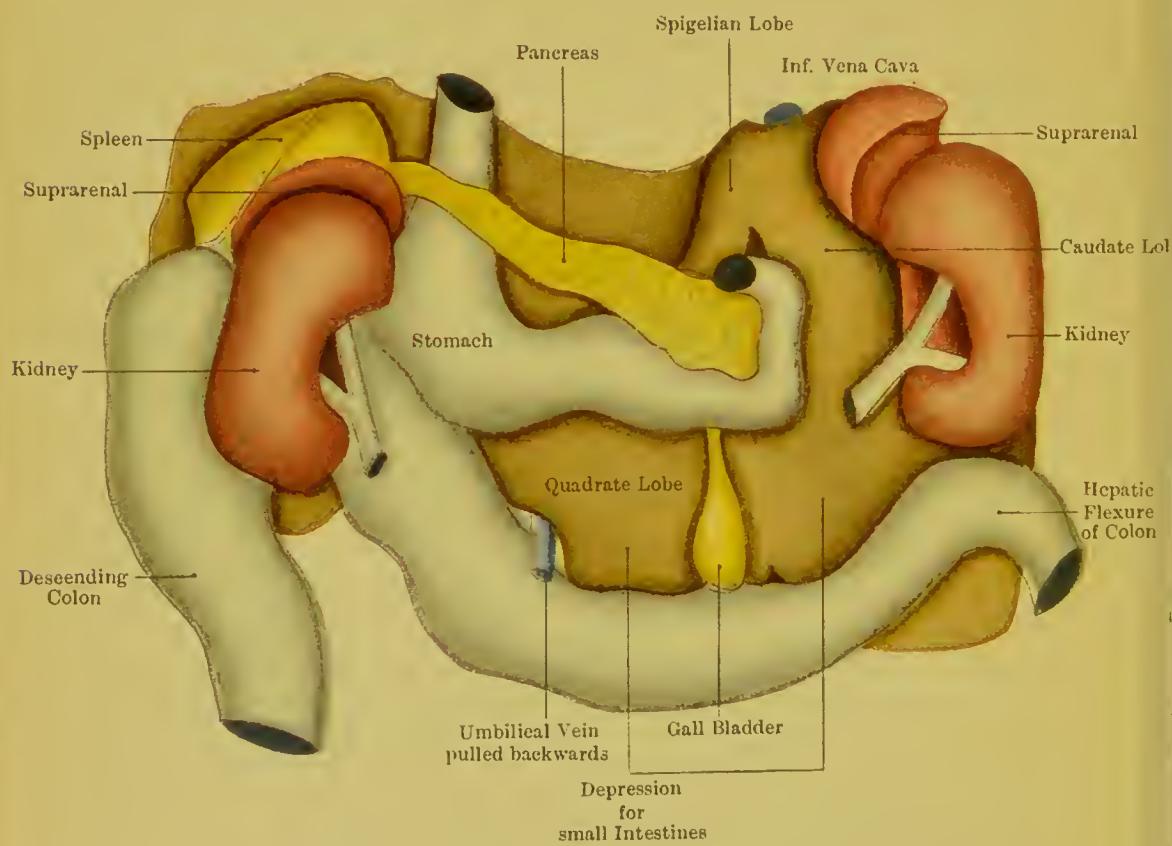
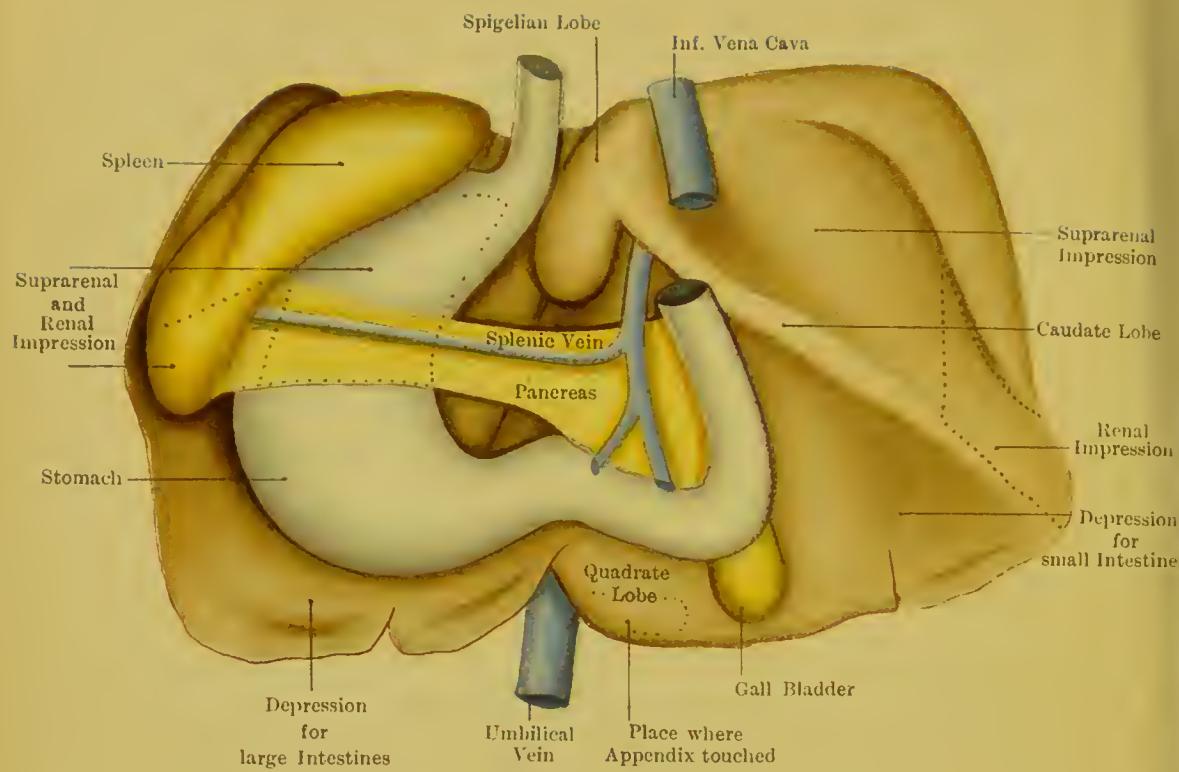


FIG. XIII. TWO DISSOLUTIONS SHewing SOME OF THE RELATIONS OF THE LIVER IN THE INFANT.

since should it become calcareous it might easily be mistaken for a calculus in the duct.

In *A* the liver is pulled very much upwards, so that the lower end of the inferior cava, which is cut, points upwards, and the upper end downwards. The gastrohepatic omentum is partially removed. Two well-marked grooves are seen on the under surface of the quadrate lobe, caused by the first part of the subjacent duodenum.

In *B* the middle pancreatico-duodenal arteries arising from the superior mesenteric are shown. The Spleen, which has become somewhat displaced downwards, is seen to be lying in a groove on the under surface of the left lobe of the liver—a very common condition in the foetus and infant, and a not uncommon one in the adult.

FIG. XIII. represents two dissections taken from full term infants. In both, this intimate relation of the spleen to the liver is shown. In the upper figure, the vermiform appendix was found to be in contact with the under surface of the quadrate lobe; the areas occupied by the kidneys and suprarenal bodies are indicated by dotted lines. The large spaces occupied by the latter is very noticeable.

In the lower figure the spleen at the time of dissection was beginning to soften; it assumed, in consequence, a peculiar shape. It is seen, however, to be entirely covered in front by the liver.

Both dissections show the large surface on the under surface of the liver of the infant which is

occupied by the transverse colon, while the area occupied by the stomach is relatively very small. The small intestines in the infant usually come into contact with some portion of the under surface of the liver. This is indicated in both figures.

Sappey, Plate XXV., represents sixteen glands running along the lesser curvature of the stomach and over the lower end of the anterior face of the œsophagus, and ten glands along the greater curvature of the stomach.

In Plate XXVI. he represents a small chain of glands running vertically along the left margin of the Spigelian lobe, and a transverse group surrounding the back part of the inferior cava just before it perforates the diaphragm. These two latter groups are certainly not usually seen.

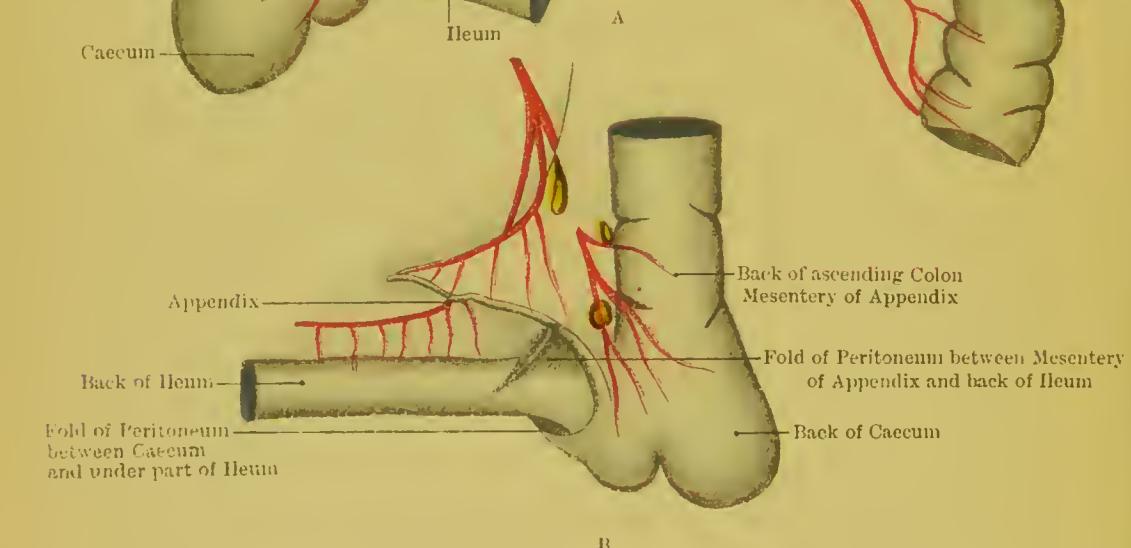
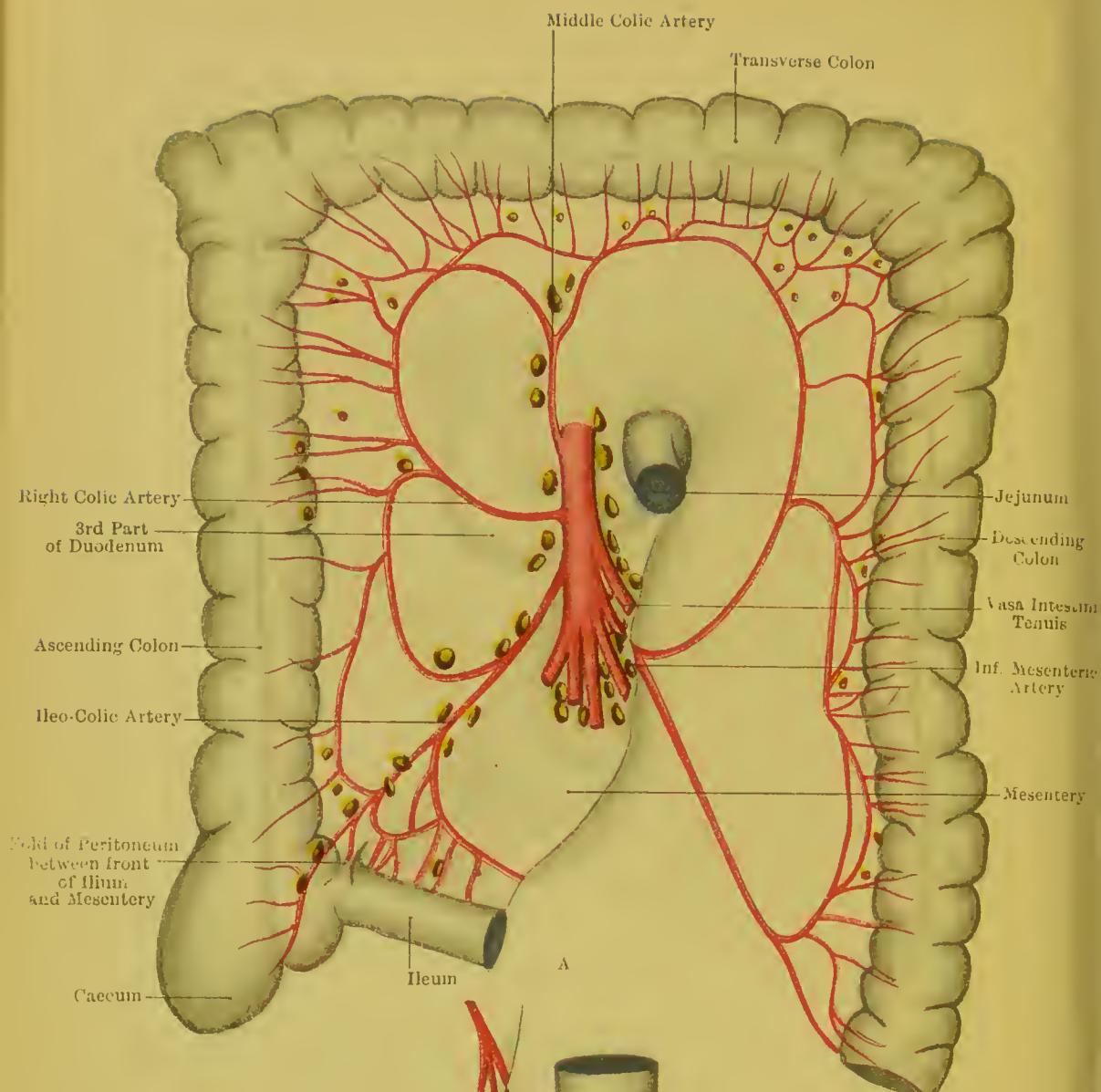


FIG. XIV. DISSECTION SHewing LYMPHATIC GLANDS OF COLON AND CÆCUM.

FIG. XIV.—INTESTINAL GLANDS.

This Fig. represents the glands of the ascending, transverse, and descending colon, and the ileocecal region, and those in connection with the “*vasa intestini tenuis*.” The groups may be thus classified:

1. *Superior Mesenteric*. A large and constant group, consisting of six or more large glands, which are disposed round the superior mesenteric artery, after this vessel has emerged from the under surface of the pancreas, and as it lies upon the third part of the duodenum.

2. *Vasa Intestini Tenuis*. Ten or more large glands grouped round the origin of the *vasa intestini tenuis*.

3. *Ileocolic*. Ten or more glands, which vary in size from an almond to a pea, which follow the course of this artery; the glands decrease in size as they are traced downwards. This group is very constant. The ileocolic artery terminates in what may be called the anterior cœcal branch, which is distributed to the anterior part of the cœcum. As described by Treves, shortly before it reaches this position on the gut it strips off a double fold of the peritoneum from the lower end of the mesentery; between this fold and the lower end of the mesentery is found the superior iliocecal fossa.

In *A* this fossa is shown; the anterior layer of the double fold of peritoneum having been removed, the anterior cœcal termination of the artery and the two or more lymphatic glands, which are included in this fold and which lie on the anterior surface of the cœcum, are exposed.

The ileocolic artery also gives off the following branches :—

- (1) To vermiform appendix.
- (2) Posterior cœcal.

The former runs in the free edge of the mesentery of the appendix, giving branches to this organ ; the latter passes to the back of the cœcum, and descending colon, to which, as well as to the root of the appendix, it gives numerous branches. Three or more glands are frequently found in the mesentery of the appendix in close connection with the artery to the appendix, and posterior cœcal branch. These are shown in *B*. The actual number and disposition of the fossæ in this region is variable. On the anterior aspect, however, the superior ileocœcal would seem to be generally caused by the anterior cœcal branch of the ileocolic artery ; but on the posterior aspect the presence or absence of the fossæ would seem to be determined, first of all by the actual position of the appendix, and secondly, by the presence or absence of a well marked mesentery to this organ. Should this latter be present a fossa is usually found between it, on the one hand, and the mesentery of the ileum,

and the ileum itself on the other ; this latter fossa is often subdivided by a fold which passes from the back of the ileum to the back of the appendix.

In addition it is not uncommon to find a small fold of peritoneum passing from the under surface of the ileum to the cœcum. These folds are shown in *B*.

4. *Middle Colic.* A group of four or more glands which follow the course of the middle colic artery. Of this group two or more glands are usually found where the artery divides into right and left branches. The ileocolic, right, middle, and left colic arteries form primary loops, from which secondary, and sometimes tertiary loops are formed ; from these, the terminal branches proceed to the gut. The remaining glands of the large intestine are usually small, and situated for the most part between the secondary and tertiary, and between the branches given off by them to the gut. In the case of the ascending colon the glands are usually very scanty ; especially is this the case in the first half of its course.

In the transverse meso-colon the glands are more numerous, being usually found in greatest numbers at the hepatic and splenic extremities. In the meso-colon the glands again become very scanty. It should be noticed that whereas there is usually a well marked group of glands round the trunks of the ileocolic and middle colic arteries, that of the left colic is usually quite destitute of glands. A few

glands are often found lying on the inner borders of the ascending and descending colon.

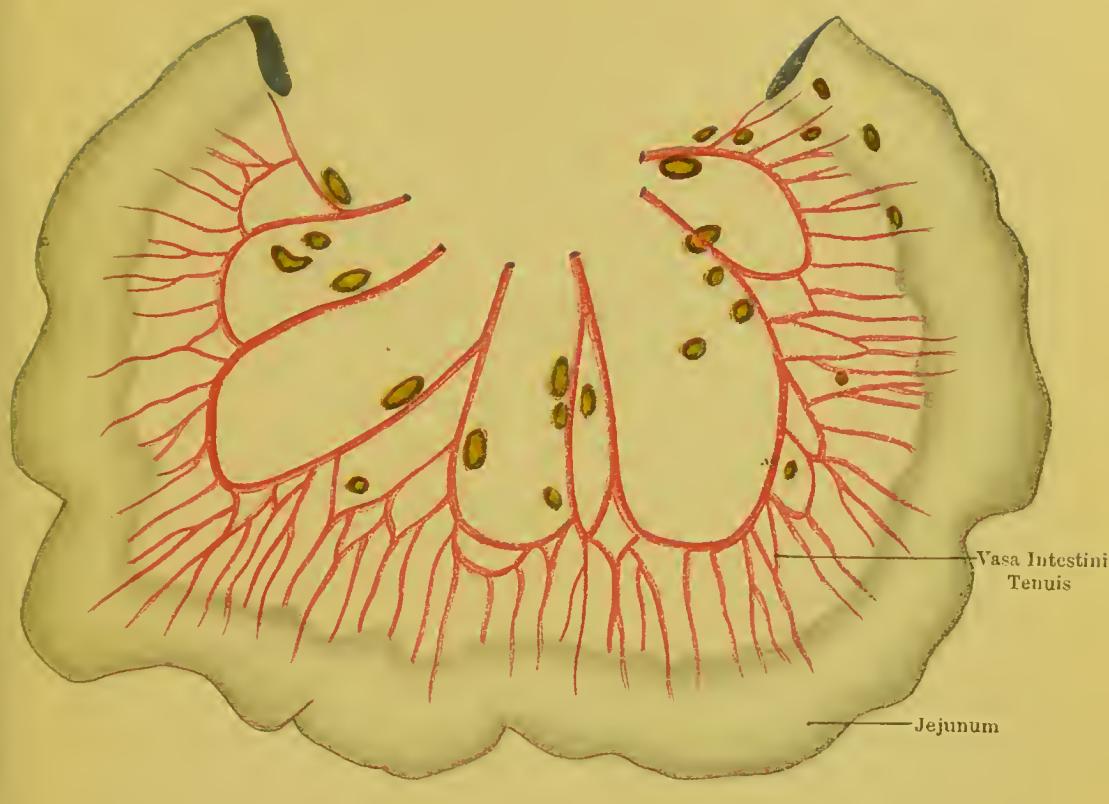
The glands of the meso-sigmoid are arranged in precisely the same plan as in the rest of the large intestine; not more than four to ten are usually present, but the actual number varies considerably. In the case of the meso-rectum one or more may be present, but most usually they are absent altogether.

FIG. XV.

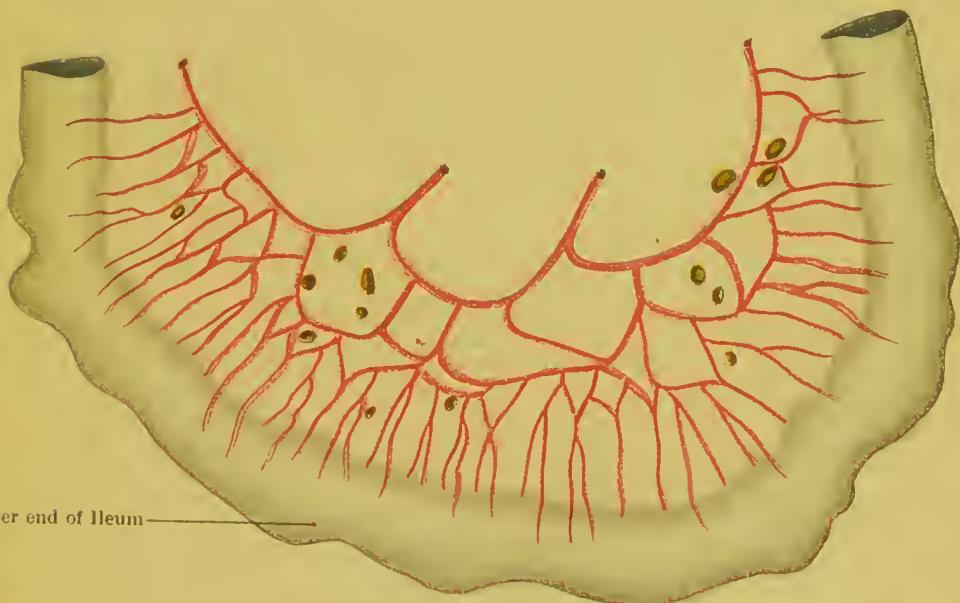
A. The glands of the jejunum and upper part of the ileum are found for the most part between the primary loops of the *vasa intestini tenuis*. These glands are usually of large size, and are directly continuous with the *vasa intestini tenuis* group mentioned in the previous section.

In addition it is most usual to find two or three small glands lying on the anterior surface of the upper end of the jejunum. Also, scattered throughout the mesentery of the jejunum and upper part of the ileum, there are small glands situated between the secondary and tertiary loops of the *vasa intestini tenuis*, but in this part of the gut these latter glands are never so numerous or so large as those found between the primary loops, and frequently they are very scanty.

B. As the gut is traced towards the ileocœcal regions the lymphatic glands diminish very much in size and actual number; those which are found are situated not so much between the primary as between the secondary loops of the *vasa intestini*.



A



B

FIG. XV. DISSECTION SHOWING LYMPHATIC GLANDS OF MESENTERY.

tenuis. Towards the lower end of the ileum one or more glands may be frequently found lying between the terminal branches of the iliac branches of the ileocolic artery. They are situated a quarter of an inch above the upper margin of the gut.
A. Fig. 11.

Mascagni, Tab. XV., represents the majority of glands lying within the primary loops of the *vasa intestini tenuis*.

In Quain's *Anatomy*, Vol. II., Part II., the glands are thus described : "The mesenteric glands vary in number from 130 to 150 or more. They are seldom larger than an almond ; they are most numerous in that part of the mesentery which corresponds to the jejunum, and except at the lower end of the ileum they are seldom found closer to the intestines than $1\frac{1}{2}$ or 2 inches. The largest are placed round the trunk of the superior mesenteric artery, but the greater number lie within the loops formed by the vessels between the layers of the mesentery, becoming smaller and increasing in number as they are nearer to the intestines."

From dissections, however, it would appear that the number of mesenteric glands varies within wider limits than here described : it being very common to find not more than 40 or 50. Moreover, it will generally be found that the glands diminish, not only in size but also in number, as they are traced downwards, and as described above ; some usually lie close to and over the upper end of the jejunum.

FIG. XVI.—PELVIC GLANDS.

This diagram represents the glands of the pelvis. The sacrum and coccyx and symphysis pubis are cut through in the middle line; the left common iliac artery is drawn forward.

The *most constant* groups are the following :—

A. Aortic bifurcation. Three or more glands placed immediately underneath the bifurcation of the aorta ; they lie over the common iliac vein, and over the body of the fifth lumbar vertebra.

B. Common iliac bifurcation. Two or more glands placed underneath the bifurcation of the iliac artery.

C. External iliac. Two, three or four small or large glands placed on the outer side of the artery between it and the psoas muscle : it is rarely represented by more than four, and frequently by only one or two glands. The highest gland of this group is usually found partially projecting underneath the commencement of the external iliac artery. This set of glands is not nearly so constant as most text books would lead us to suppose.

D. Epigastric. This group in the adult consists of two or three oval-shaped glands placed transversely over the lower end of the external iliac artery and vein, and more or less surrounding the

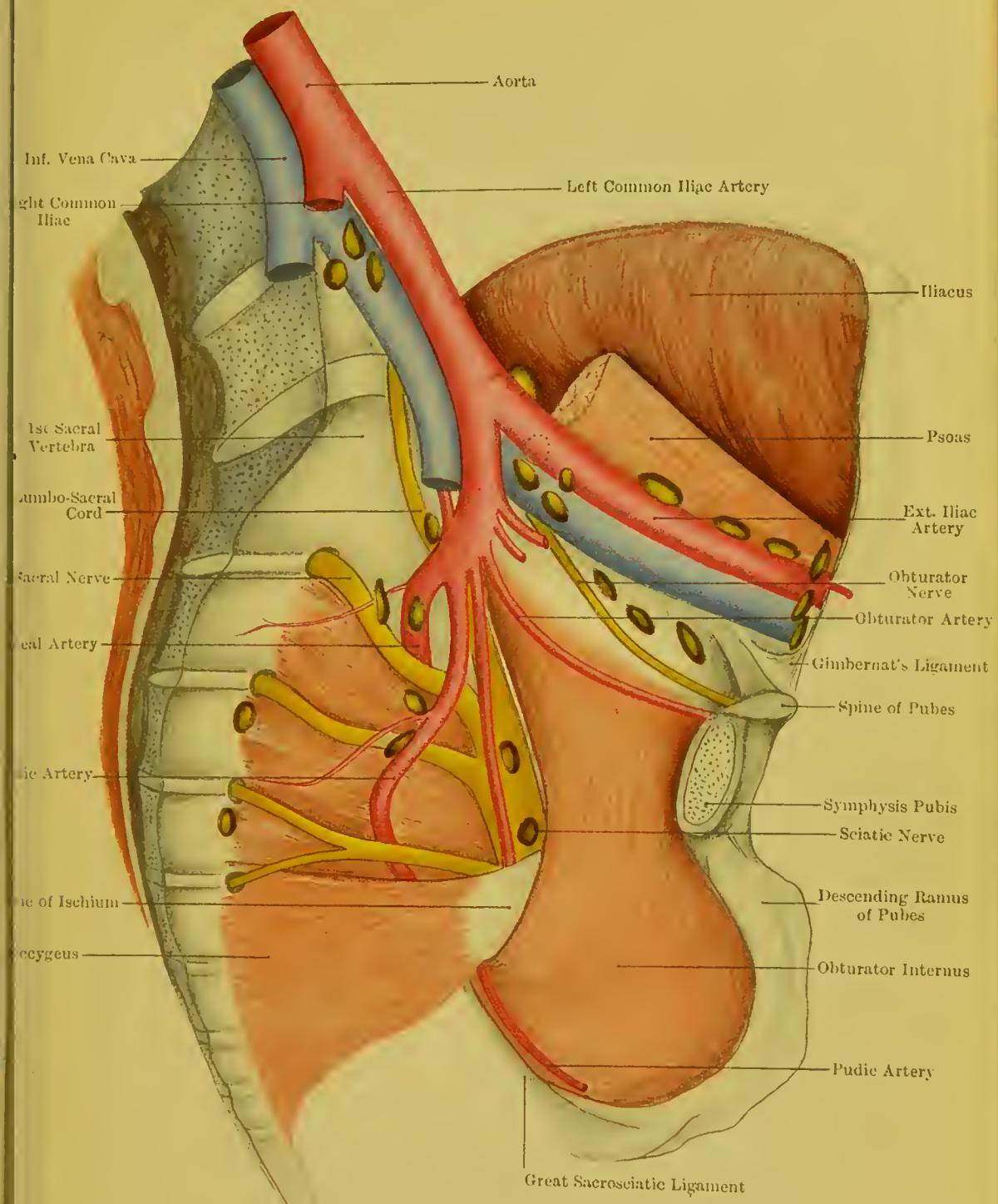


FIG. XVI. DISSECTION SHewing LYMPHATIC GLANDS OF PELVIS.

origin of the deep epigastric artery. In the foetus two or three small glands are frequently found following the course of the artery on to the posterior portion of the abdominal wall. But these are absent in the adult.

E. Obturator. This group is termed obturator since it consists of two to four oval glands which lie between the external iliac vein and the obturator nerve. In some cases these glands form a regular chain extending from the femoral ring to the common iliac bifurcation group. Sometimes the lowest member of this group is found projecting through the crural canal. The relation of this gland to Gimbernat's ligament is important, since from its position it is clear that if it should become enlarged it would give rise to a tumour, occupying a position similar to that of a femoral hernia ; and cases have been recorded where this gland on becoming inflamed has caused symptoms identical with those of a strangulated femoral hernia.

F. Internal iliac.—These are glands which are situated in close relation to some of the branches of the internal iliac artery. The most constant of this set are :—

1. *Gluteal.* Two or more glands are very frequently found on the gluteal artery, as this vessel lies between the lumbosacral cord and the first sacral nerve, before it passes over the upper border of the pyriformis muscle to emerge through the great sacrosciatic foramen. Included in this group

may be mentioned a gland which is often found in the angle between the ileolumbar and posterior division of the internal iliac artery. It is not shown in the figure.

2. *Internal pudic.* Two or more glands lie over this artery before it emerges through the great sacrosciatic foramen; no glands are to be found on this artery as it traverses the ischiorectal fossa, or as it lies between the two layers of the triangular ligament.

3. *Sciatic.* Two or more glands lie on the sciatic artery as this vessel rests on the pyriformis muscle.

The less constant groups found in the pelvis are :—

G. Sacral. Four glands are sometimes seen, two lying on either side of the middle line of the hollow of the sacrum. They are usually found over the junction of the second and third, and third and fourth sacral vertebrae to the inner side of the lateral sacral arteries. These glands, however, are most inconstant, and in most cases entirely absent. In carcinoma of the rectum, however, several large glands are usually found in this situation.

H. Coccygeal. A gland lying on the tip of the coccyx on rare occasions is to be found; its presence, however, is quite exceptional.

I. Uterine. A gland is sometimes present situated between the layers of the broad ligament, on the side of the uterus quite close to the neck, and placed over the uterine artery. It is very rare.

Lucas and Championierre (*Lymphatiques uterus*, Th. de Paris, 1870) have also described this gland as being situated on the side and front of the uterus.

J. Rectovesical. One or two glands are sometimes found in the rectovesical, uterosacral, or vesicovaginal folds of the peritoneum.

It will be seen that nearly all the pelvic glands are in the closest relation to nerves, viz., the external iliac group to the anterior crural nerve, the obturator to the nerve of the same name, while the gluteal, sciatic, and internal pudic, rest actually on, or lie very close to, the first and second sacral and the great sciatic nerves.

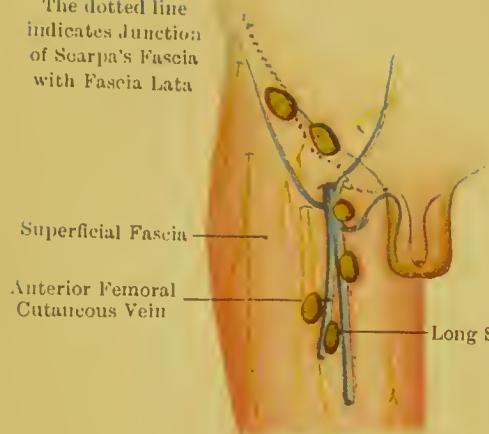
The lymphatic vessels from the external iliac group pass both over and under the vessels to communicate with the obturator glands, which latter receive a considerable number of those lymphatic vessels which have passed through the femoral canal. In advanced cases of carcinoma of the rectum or uterus, the obturator, epigastric, and external iliac groups become considerably affected, and oedema of the legs often results. The frequency of this occurrence is explained, not only by the pressure which the affected glands exert upon the external iliac vessels, but also by the fact that the lymphatic vessels by reason of their passing both over and under the external iliac vein, on becoming affected compress this vein in a ring-like carcinomatous mass. The pain experienced in

these cases is obviously explained by the proximity of the affected glands to the large nerve trunks arising from the lumbosacral plexus.

A good description, with a diagram of the pelvic glands, will be found in the *Journal of Anatomy and Physiology* (Report of Committee of Collective Investigation), October, 1897, pp. 172-177. A gland called the hypogastric is there described as lying on or near the anterior division of the internal iliac artery, near the point of origin of the superior vesical artery. The presence of this gland has also been observed by Sappey, who also mentions two glands which are sometimes found at the base of the vesiculae seminalis. Both these are very rarely present.

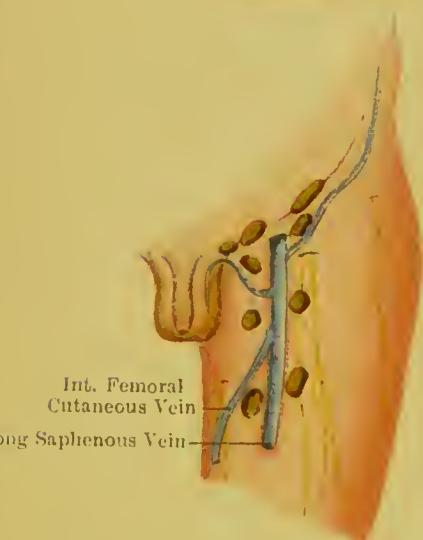
Cruveilhier mentions a constant obturator gland situated on the internal surface of the obturator foramen. Poirier denies this, maintaining that the gland nearest to the canal will be placed 15 to 20 mm. above and behind the foramen. Certainly no gland is usually present in the obturator foramen.

The dotted line indicates Junction of Scarpa's Fascia with Fascia Lata



Saphenous
Opening

I.



Long Sphenous Vein

Femoral Vein

Fascia Lata

II.

III.



Long
Sphenous Vein

Femoral Vein

Fascia Lata

III.

FIG. XVII. DISSECTIONS SHOWING THE INGUINAL SYMPATHETIC GLANDS.

FIG. XVII.—GLANDS OF THE GROIN.

This figure represents three dissections showing the arrangement of the lymphatic glands of the groin. In the figures on the left hand the superficial glands, in those on the right hand the deep glands only are shown.

The lymphatic glands of the groin are usually divided into *Superficial* and *Deep*.

The *Superficial* are divided into *horizontal* and *vertical*.

The *Horizontal* consist of two to four glands placed along Poupart's ligament. These are embedded in Scarpa's fascia or in the junction of this with the deep fascia; below this there are usually two glands, one of which is most commonly found in the angle between the long saphenous and circumflex iliac vein, and the other in the angle between the long saphenous and superficial external pudic vein. Of the horizontal set, the gland placed about the centre of Poupart's ligament is usually the largest.

The *Vertical* set consist of two to five glands placed over the upper part of the long saphenous vein. Of this group two or more glands are constantly found on the outer side of the vein,

lying over the two parallel branches of the middle cutaneous nerve, and one gland, very constant in position, is found in the angle between the anterior femoral cutaneous and the long saphenous vein. Again another is frequently found in the angle between the internal femoral cutaneous and the long saphenous vein.

The *Deep* glands vary somewhat in number and position. Very frequently they are absent entirely. The one most constantly found is embedded in the fatty layer round the saphenous opening. This cannot, correctly speaking, be considered either superficial or deep, as most usually part of it is found underneath, and part of it overlapping, the fascia lata. This gland bears exactly the same relation to the fascia lata that the central group of glands bear to the axillary fascia. Two small glands are sometimes found to the outer side of the femoral vein, but these again are very inconstant.

The glands which are more definitely underneath the fascia lata are found to the inner side of the femoral vein ; most usually they are two in number, the lower of which lies to the inner side of the femoral vein entirely underneath the fascia lata, the upper lies in the same situation, but its apex may be found projecting just above the lower margin of the saphenous opening. These two glands are often replaced by a single one about the size of a bean, underneath the fascia lata in the angle between the junction of the femoral and long saphenous

vein. By a reference to Fig. XVII. the position both of the superficial and deep glands can be readily understood. One or two glands are sometimes found within the crural canal, but they are not constant. In some cases the gland or glands found within the crural canal are in direct continuity with the obturator group previously mentioned.

Mr. Keith has shown that in all animals, with the exception of man, the glands of the inguinal region do not consist of a horizontal and vertical set, but are closely bound together in a web which represents Scarpa's fascia. This web of tissue is present in all mammals and amphibians, and serves the double purpose of binding down the skins to the groin and forming a mesentery for the passage of blood vessels and lymphatics from the skin to the deeper structures; the glands are contained in this mesentery or web. He considers this structure in man is represented by Scarpa's fascia, but owing to the great extension of the thigh on the body in the upright posture, its position has become greatly altered, and thus the vertical set of glands come to lie completely outside Scarpa's fascia, while the horizontal set lie partially embedded in it.

In connection with this point, it should be noticed that the attachment of Scarpa's fascia to the fascia lata is by no means definite. In the dissecting room it is always difficult to say exactly where one ends and the other commences. The best way to demonstrate the attachment of Scarpa's fascia is to insert a

blowpipe underneath Colles's fascia and distend the superficial perineal interspace with air; this will pass over Poupart's ligament, but will not, in most instances, pass down the thighs farther than the lower margin of the saphenous opening. The approximate level of junction of Scarpa's fascia with the fascia lata is indicated by dotted lines in the upper and lower figures on the left side. In some cases, however, the air may be observed to pass down almost as far as the knee joint, showing either that Scarpa's fascia is so loosely attached to the fascia lata that the two can be easily separated, or else that the junction of the two takes place low down. In any case, the fact shows the anatomical possibility of extravasated urine being sometimes able to pass some considerable way down the thighs.

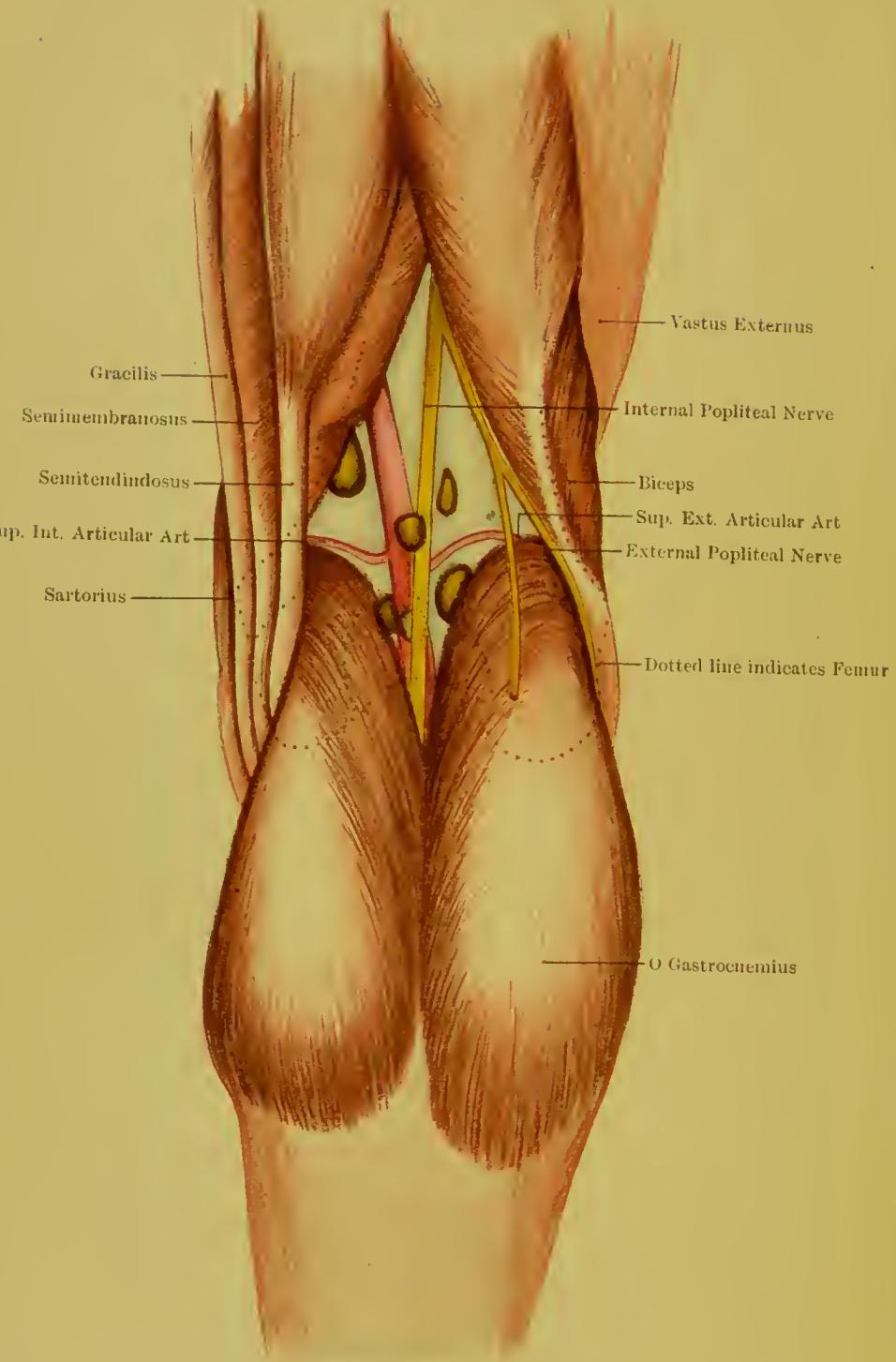


FIG. XVIII. DISSECTION SHewing POPLITEAL LYMPHATIC GLANDS

FIG. XVIII.—POPLITEAL GLANDS.

The popliteal glands in the adult are usually very scarce, not more than two or three being present: In the foetus and the child, however, they are more numerous and better marked. They may most conveniently be divided into *superficial* and *deep*.

The former consist of usually one gland the size of a pea found in the superficial fascia and lying over or in close relation to the internal popliteal nerve.

The *deep* glands may be divided into two groups.

A. Intercondylar. These are two or three glands found between the two heads of the gastrocnemii muscles; these lie on either side of the popliteal artery, one is frequently found between it and the internal popliteal nerve.

B. Supracondylar. This group consists of one to three glands which lie against the back of the femur, and which are consequently deeper than those of the previous group. One gland belonging to this group is sometimes found quite close to the inner side of the popliteal artery, partially projecting under the tendon of the adductor magnus; the other two, if present, are usually found in the angle which the superior internal articular and superior external

articular arteries make respectively with the popliteal artery.

The popliteal glands are extremely difficult to feel unless they are enlarged, and even then the only one which can be detected is that which lies over the internal popliteal nerve. This gland, probably from the constant movement of the knee joint, is very apt to suppurate as a result of superficial sores about the heel.

The intercondylar glands cannot be felt: in the first place, because of their deep position, and secondly, because when pressed they become still further forced down between the condyles. The supracondylar glands lie altogether too deep to be felt by the fingers. In the figure the outline of the lower end of the femur is indicated by a dotted line, and consequently the relation which the glands bear to the condyles can be easily appreciated.

The anterior tibial gland is very rarely present. It is a small gland which lies over the artery after this vessel has perforated the interosseous membrane; it is sometimes double.

Hewson has seen the gland situated lower down, just above the centre of the leg.



✓

